

# Radio Fun

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"The beginner's guide  
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**in**  
this issue

## features

- 1 Welcome to Radio Fun N1GPH
- 4 El CheePO WA6IVC
- 8 10m Vertical Dipole W8DYF
- 10 Custom-Made Project  
Boxes AH2AR/8
- 13 An Amateur Packet  
Radio Overview NM1D
- 15 Proper Terminology K6ZFY
- 16 Busting a Pile-Up K2SDD

## reviews

- 21 Ramsey SR-1  
Receiver WA9PYH
- 22 Ramsey QRP-40  
Transmitter WB0E

## departments

- 27 Ad Index
- 29 Classified Ads
- 24 Radio Magic WB8VGE
- 1.19 Radio News Staff
- 25 The Tech Side KB1UM
- 18 Try Something New WB8ELK
- 5 Upgrade... Don't Stop  
Now! WB6NOA
- 12 What Next? WB2MGP

## First New Technician

The first no-code Technician license was issued to Robert N. Williams of Annapolis, Maryland, on March 12. His callsign is N3IFY. The coordinating VEC was the Laurel Radio Club.

In February 1991, the FCC said that they had received 313 applications for the new codeless Technician operator license. The FCC reminded VEs that: "To obtain a telegraphy CSCE (Certificate of Successful Completion of Examination) to upgrade by examination to Technician Plus [5 wpm code] after qualifying for codeless Technician, the examination must be administered in the [3 examiner] VEC system, not in the Novice [2 VE] program."

TNX W5YI Report, April 1, 1991.

## Amateur Radio Growth

The FCC released statistics through September showing steady annual growth in amateur radio licensing. In 1990, there were 26,134 new licenses, compared to 17,373 in 1985. Upgrades also grew in the same period, from 16,184 to 29,699. The total number of licensees grew from 464,800 in 1989 to 494,292 in January of 1991. TNX *The Wave Guide*, Jan. '91.

## Premier Collector's Issue

# Welcome to Radio Fun

## A new amateur radio magazine.

by David Cassidy N1GPH, Associate Publisher

You hold in your hands the premier issue of a brand new amateur radio magazine, *Radio Fun*. The concept and philosophy of this new magazine are contained in the title: We want your radio hobby to be fun. We want to help you get the most out of your license, help you to upgrade to a higher license, introduce you to new modes, and assist you in building a project... all of the million and one things that make up this great hobby.

Though this publication will always be written from a newcomer's point of view, we think that even the oldest Extra will find something of interest in every issue. From operating hints to easy construction projects, from reviews of old rigs to reviews of the latest kits, from HF rag-chewing to the latest fun mode... you'll find it

all between these pages every month.

### Why A New Magazine?

A few folks have asked us why, with dwindling numbers and disappearing advertisers, we would be so foolhardy as to start a new ham radio publication. The reason is really quite simple. The currently available ham magazines are geared towards the experienced ham. Sure, the folks at 73 try to bring you as many beginner-type construction articles as we can, but we still get letters by the barrelful asking for "more easy construction articles" or "more stuff for the newcomer." With about 20,000 new Novices and Techs every year (and who knows what the recent no-code license will do to that number), we figured it was time to do something to try to keep those

newcomers interested in the hobby.

It's pretty easy to lose interest when you're struggling to make contacts on the Novice bands. Even 10 meter SSB loses its excitement after your five-thousandth boring contact. The newcomers need their own forum—their own information journal—and *Radio Fun* will be just that.

### Thanks For Your Support

We originally planned this premier issue to be sort of a prototype. We wanted to put out a small—about 24 pages—"proof of concept" issue before gearing up for the first "official" issue in September. The manufacturers wouldn't let us do that!

You'll notice that the biggest and best names in amateur radio are showing their support for the newcomers

by advertising in this premier issue.

In fact, the response from advertisers has been nothing less than overwhelming. We finally had to stop accepting ads, so that we could get the pages to the printer. We hope you'll pay special attention to the advertisers in this premier issue. They are the ones who, without even seeing what they were buying, thought this publication was important enough to put their money where their mouths were. They care about the newcomers and the future of amateur radio. They deserve your business.

The response from readers has been equally overwhelming. We've received thousands of pre-publication subscription orders at the special rate of \$9.97. We're going to con-

Continued on page 30

## 80 Meter Novice/Tech Band Change

Last January the FCC amended its rules to relocate Novice/Technician frequency privileges in the 80 meter band from 3700–3750 kHz to 3675–3725 kHz. Make this change on your charts and in your books—including your *General Class License Manual*! See Gordon West's Authorized Frequency Bands table in this issue of *Radio Fun*.

This rule change will reduce the amount of mutual interference between U.S. and Canadian amateur stations. In the U.S., the original 80 meter segment was assigned CW transmission so that beginners could improve their telegraphy skills. In Canada, frequencies in the upper half of the same segment are used for telephony.

TNX *Squelch Tales* and W5YI.

## NASA Frequencies

### Listen in to Shuttle Launches

Several radio clubs (mostly at the NASA space centers) retransmit live shuttle communications via 2m repeaters and HF frequencies during SAREX (Shuttle Amateur Radio EXperiments) missions. Look at the following frequency chart for the best signal to your location:

#### Shuttle Audio Retransmissions

WA3NAN (Goddard): 3.860, 7.165, 14.295, 21.395, 28.650 and 147.45 MHz.  
W5RRR (Johnson Space Center): 3.850, 7.227, 14.280, 21.350, 28.495 and 146.64 MHz.  
W6VIO (JPL): 14.270, 21.340 and 224.04 MHz.  
K6MF (Bay area): 3.840, 7.165 and 145.58 MHz.

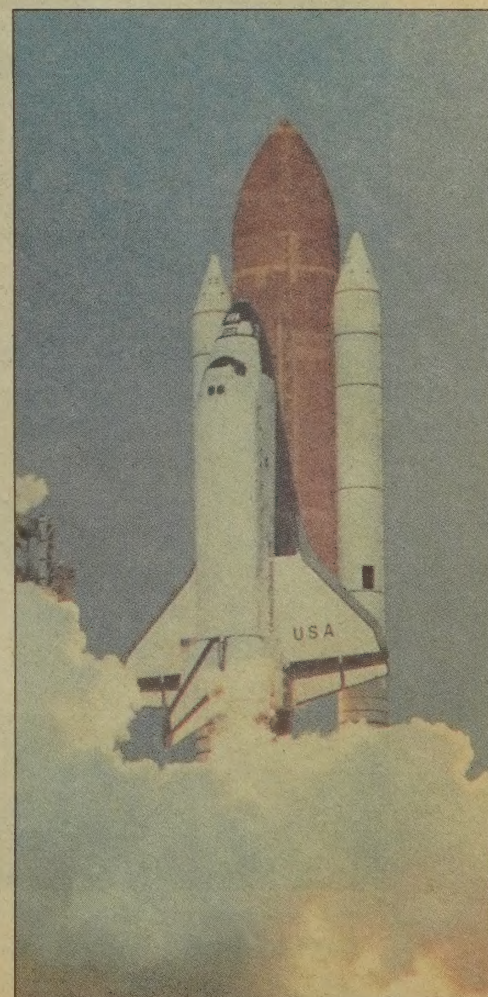
If you have a general coverage shortwave receiver, you can also listen in on shuttle and Kennedy Space Center communications during launch and re-entry phases. Try these frequencies: They also cover NASA, the U.S. Coast Guard, the Army, and the Navy. You may hear terms like "SAR," which means "Search and Rescue"; ETR, "External Tank Recovery"; SRB, "Solid Rocket Booster"; "OCC," Operations Co-ordination and Control"; and others. The frequencies below are in megahertz (MHz). HF frequencies used at the Kennedy Space Center are 2.182 and 3.023 MHz.

#### Kennedy Space Center HF Communications

2.405 Data Buoys  
2.622 SRB Recovery (Primary)  
2.664 Back-up Mission Audio  
2.678 ETR Range Control

Continued on page 19

Photo A. The *Columbia*, (mission STS-9) lifting off from launch pad 39A at the Kennedy Space Center. Astronaut Owen Garriott W5LFL operated the first shuttle amateur radio experiment (SAREX) during this mission.





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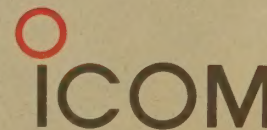
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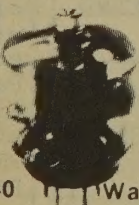
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# El CheePO

## An inexpensive code practice oscillator for your Novice class.

by Bruce O. Williams WA6IVC

When the Bastrop County Amateur Radio Club decided to conduct a Novice class for a local Boy Scout troop, it soon became evident that some code practice oscillators would be required. First problem: The troop's treasury would not support the purchase of commercial units at prices of about \$20 for each boy.

We looked at several approaches to providing a class construction project: the CPO (code practice oscillator) in the *ARRL Handbook*, purchasing some inexpensive kits, etc. We were not happy with the design in the *ARRL Handbook* because the cost was a "leech bit" high considering that we were looking at building about 20 of the units. A breadboard using a readily available NE555 chip required over 40 mA of current. A 9-volt transistor battery would not last long at that rate! Other options, such as buying CPO kits, were too expensive. The result was "El CheePO." We like to think El CheePO resulted from a little original design work (not really—I'm sure that many others have come up with the identical circuit).

### The Design

Figure 1 shows the schematic for El CheePO. The design is a simple Hartley-type audio oscillator. The first thing that you will notice is that it contains very few components: a transformer, T1; a couple of capacitors, C1 and C2; a transistor, Q1; and one resistor, R1. That's all there is to it! Just add a speaker, a key and a power source, and you're ready to go.

T1 is an inexpensive transistor radio output transformer. Its specifications are: 1k ohm primary, 8 ohm secondary. These transformers are available from many sources. [Some transformers that I have identified but not tried are: PN-M0216 from American Electronics, P.O. Box 468, Greenwood IN 46142, (317) 888-7265, \$1.00; Radio Shack part number 273-1380, \$1.59; and Mouser Electronics, 11433 Woodside Ave., Santee CA 92071,

(619) 449-2222, (800) 346-6873, price not available.] I found that the actual characteristics of any transformer are not too important—you could use salvaged output transformers from almost any transistor radio. The transformer we used cost 95 cents in a quantity of 20. Although we used a PC-mount transformer, the Radio Shack item with leads on it worked well in our original breadboard. If we hadn't found a cheaper item in a local surplus store, we'd have used the Radio Shack part.

C1 and C2 can be found in almost any junk box. The problem, of course, is quantities—I can never seem to find more than one or two of an item in my junk box. C1 and R1 determine the frequency of oscillation. We used a 0.47  $\mu$ F capacitor for C1.

An R1 value of 6.2k ohms will give you a tone of approximately 700 Hz. You will have to experiment a little with the value of R1 to get the tone you want. C2 is just a bypass capacitor, and its value isn't critical. If you

ment diagram. If using the Radio Shack transformer, you will need to strip the insulation off of the leads so that the

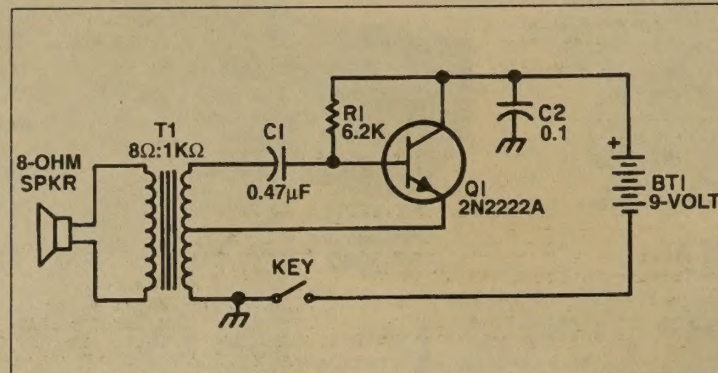


Figure 1. El CheePO schematic diagram.

bare wire just sticks out of the solder side of the circuit board.

The cost for small cabinets to house El CheePO was prohibitive, and we still had to solve the problem of building the key. We used 4-inch by 12-inch pieces of 1/4-inch plywood as a mount for the oscillator, speaker, battery and the key. We attached the stripboard to the plywood with small sheet-metal screws, and attached a 9-volt battery clip the same way. The \$1 speakers we had didn't have any mounting frames, so they were epoxied into 7/8-inch holes bored in the plywood. The key was made from 1/2-inch by 3-1/2-inch strips of G-10 single-sided PC board. Two 4-40 machine screws hold the key strip in place, and the contact is between the copper-clad side of the

board and another 4-40 machine screw mounted through the plywood. We found that 4-40 nuts on the key mounting screws provided just the right spacing for the key contacts. Four stick-

on plastic feet complete the assembly. There are several other methods of building the key, but we used the materials that were on hand.

During the actual construction process, the boys prepped the parts and inserted them into the PC board. Rather than take up valuable classroom time in a soldering class, (and considering the shortage of soldering irons, etc.) we had two BCARC members doing all the soldering. In your class, I would recommend a soldering class if at all possible. "Madhouse" is the only term appropriate to describe 15 or so boys,

each with an urgent soldering requirement, grouped around one old man with a soldering station. "Mine first!" and "Golly, I'm always last," seemed to be the order of the evening.

### Summary

We built 20 El CheePOs. The average cost of each unit was about \$4. The results were immediately evident in the class. We were attempting to teach code by just sending from practice tapes, but once El CheePO was available, our students started taking a more active part by pairing up to send and receive code on their own initiative, and on their own time outside of class.

Was it worth it? You bet it was! We think that about half of the class will eventually be licensed. Many of the younger members that are not sufficiently motivated now will eventually get their licenses, too. If you really want a satisfying experience, get involved with some of these fine young people that we must depend on to carry on our hobby. Go CheePO! **RF**

Contact Bruce O. Williams WA6IVC at Rt. 1 Box 156C, Smithville TX 78957.



Actual Size

Figure 2. PC board layout (bottom view of foil pattern).

use a different value for C1, some experimentation will be required to select R1.

For example, with C1 = 0.1  $\mu$ F, then R1 should be 15k ohms.

### Construction

Construction is easy with the etched and drilled PC (printed circuit) board from FAR Circuits. Mount the components according to the parts place-

board and another 4-40 machine screw mounted through the plywood. We found that 4-40 nuts on the key mounting screws provided just the right spacing for the key contacts. Four stick-

### parts list

BT1	9V transistor radio battery
C1	0.47 $\mu$ F (0.1 $\mu$ F alternate) capacitor
C2	0.1 $\mu$ F capacitor
Q1	2N2222A NPN general purpose transistor
R1	6.2k ohm (15k if C1=0.1 $\mu$ F), 1/4W resistor (Select value for desired tone.)
T1	Miniature transistor radio audio output transformer, 1000 ohm CT primary, 8 ohm secondary. Radio Shack part number 273-1380. (see text).
PC board	A blank PC board is available for \$1.75 + \$1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

Miscellaneous: 9V battery holder, small speaker, mounting hardware (4-40 screws and nuts, stick-on feet, etc.).

**NOTE:** You can use a 0.1  $\mu$ F capacitor for C1 if you use a 15k resistor for R1.

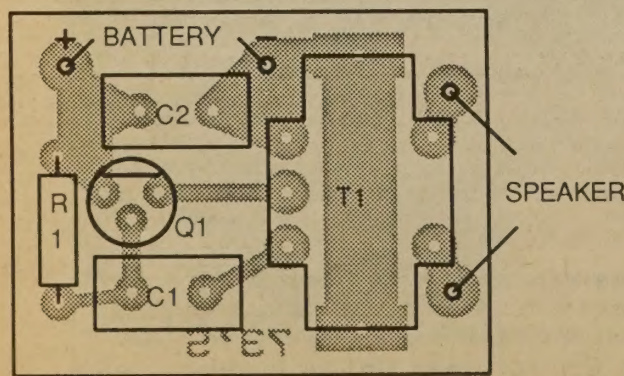


Figure 3. Parts placement (as viewed from top side of board).

## Radio Fun

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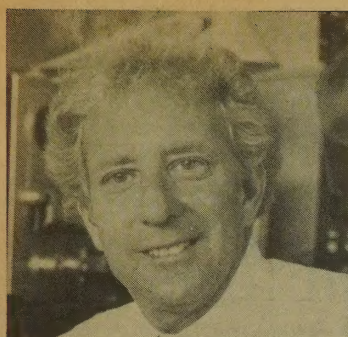
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# upgrade... don't stop now!

by Gordon West WB6NOA

Welcome to amateur radio! And welcome to the country's first magazine specifically for the first-timer on the amateur radio airwaves.

Our amateur radio hobby is a very specialized sport, for which only a half-million Americans have studied hard like you did, and qualified for one of these grades of amateur radio license:

License Class	Number of American Operators
Extra	53,000
Advanced	104,500
General	120,000
Technician-Plus	125,500
Technician-No Code	Brand new! Maybe 5,000 by now.
Novice	95,000

So what class are you? If you passed Element 1A, the 5 wpm code test, and the Novice written exam, Element 2, in front of two General class ham buddies, you are a NOVICE CLASS operator. Congratulations—Novice operators make up approximately 21 percent of our U.S. amateur radio licensing.

Did you just pass Elements 2 and 3A, the written tests for both Novice and Technician class? If so, welcome to amateur radio as a new TECHNICIAN NO-CODE CLASS operator. This is a brand new way into amateur radio, and since this was just allowed as of last February 14, as a group, you are probably less than 1 percent of all licensed

operators in your class!

If you just passed your 5 wpm code test, Element 1A, and also your Novice and Technician written tests in front of three accredited volunteer examiners, then welcome to amateur radio as a TECHNICIAN-PLUS CLASS operator—the "plus" standing for "plus code credit."

Each of these licenses have powerful privileges on the ham radio bands for voice, digital modes, and CW. And right now, the most popular license for entry into the amateur radio ranks is the new Technician no-code license. Actually, the license really isn't new, nor is the study material—but being able to obtain voice privileges on VHF and UHF bands without a code test IS new!

## Frequency Privileges

The Technician no-code license allows all privileges from 6 meters and up! This gives you the excitement of Sporadic E long-range SSB contacts on 6 meters; FM and packet radio on 2 meters, the country's most popular band; moonbounce, digital, and voice repeater operations on 222 MHz on the 1-1/4 meter band; remote base, amateur television and satellite operation on 440 MHz on the 70 centimeter band; experimental work on 900 MHz on the 33 centimeter band; and repeaters and amateur television on 1270 MHz on the 23 centimeter band—plus a lot more!

If you pass only the Novice tests, you still have plenty of voice privileges—on 222 and 1270 MHz, and

best of all, long-range SSB voice communications on a portion of the 10 meter band. You also have exciting long-range CW privileges on 10 meters, 15 meters, 40 meters, and 80 meters.

Be sure to remember they just changed the CW portion on 80 meters—it was 3700-3750, but now it is 3675-3725.

If you now have a Technician-Plus license, you get both the excitement of long-range CW and long-range voice transmissions on a portion of 10 meters, plus all the excitement on the VHF and UHF frequencies on 6 meters

Continued on page 6

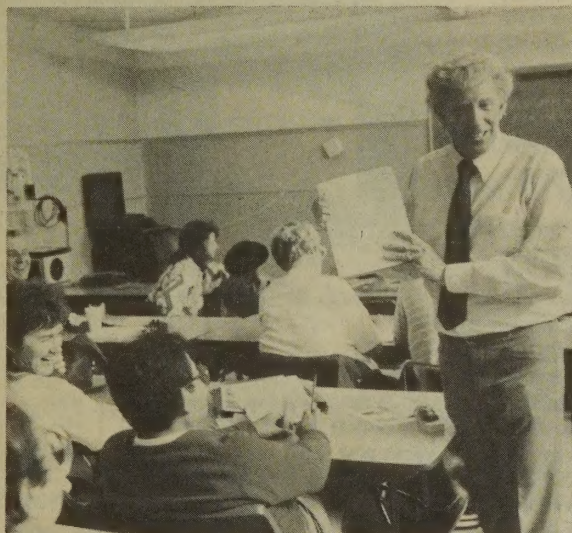


Photo A. Gordon explains the next upgrade level to his college class students.

## AUTHORIZED FREQUENCY BANDS - AMATEUR SERVICE

(for U.S. Amateur Stations operating from ITU-Region 2-North and South America)

Meters	Novice	Technician <sup>1,2</sup>	Technician Plus <sup>2</sup>	General	Advanced	Extra Class
160				1800-2000 kHz/All	1800-2000 kHz/All	1800-2000 kHz/All
80	3675-3725 kHz/CW		3675-3725 kHz/CW	3525-3750 kHz/CW 3850-4000 kHz/Ph	3525-3750 kHz/CW 3775-4000 kHz/Ph	3500-4000 kHz/CW 3750-4000 kHz/Ph
40	7100-7150 kHz/CW		7100-7150 kHz/CW	7025-7150 kHz/CW 7225-7300 kHz/Ph	7025-7300 kHz/CW 7150-7300 kHz/Ph	7000-7300 kHz/CW 7150-7300 kHz/Ph
30				10.1-10.15 MHz/CW	10.1-10.15 MHz/CW	10.1-10.15 MHz/CW
20				14.025-14.15 MHz/CW 14.225-14.35 MHz/Ph	14.025-14.15 MHz/CW 14.175-14.35 MHz/Ph	14.0-14.35 MHz/CW 14.15-14.35 MHz/Ph
15	21.1-21.2 MHz/CW		21.1-21.2 MHz/CW	21.025-21.2 MHz/CW 21.3-21.45 MHz/Ph	21.025-21.2 MHz/CW 21.225-21.45 MHz/Ph	21.0-21.45 MHz/CW 21.2-21.45 MHz/Ph
12				24.89-24.99 MHz/CW 24.93-24.99 MHz/Ph	24.89-24.99 MHz/CW 24.93-24.99 MHz/Ph	24.89-24.99 MHz/CW 24.93-24.99 MHz/Ph
10	28.1-28.5 MHz/CW 28.3-28.5 MHz/Ph		28.1-28.5 MHz/CW 28.3-28.5 MHz/Ph	28.0-29.7 MHz/CW 28.3-29.7 MHz/Ph	28.0-29.7 MHz/CW 28.3-29.7 MHz/Ph	28.0-29.7 MHz/CW 28.3-29.7 MHz/Ph
6		50-54 MHz/CW 50.1-54 MHz/Ph	50-54 MHz/CW 50.1-54 MHz/Ph	50-54 MHz/CW 50.1-54 MHz/Ph	50-54 MHz/CW 50.1-54 MHz/Ph	50-54 MHz/CW 50.1-54 MHz/Ph
2		144-148 MHz/CW 144.1-148 MHz/All	144-148 MHz/CW 144.1-148 MHz/All	144-148 MHz/CW 144.1-148 MHz/All	144-148 MHz/CW 144.1-148 MHz/All	144-148 MHz/CW 144.1-148 MHz/All
*1.25	222.1-223.91 MHz/All	220-225 MHz/All	220-225 MHz/All	220-225 MHz/All	220-225 MHz/All	220-225 MHz/All
0.70		420-450 MHz/All	420-450 MHz/All	420-450 MHz/All	420-450 MHz/All	420-450 MHz/All
0.35		902-928 MHz/All	902-928 MHz/All	902-928 MHz/All	902-928 MHz/All	902-928 MHz/All
0.23	1270-1295 MHz/All	1240-1300 MHz/All	1240-1300 MHz/All	1240-1300 MHz/All	1240-1300 MHz/All	1240-1300 MHz/All

<sup>1</sup>No-Code License <sup>2</sup>Effective 2/14/91

Note: Morse code (CW, A1A) may be used on any frequency allocated to the amateur service. Telephony emission (abbreviated Ph above) authorized on certain bands as indicated. Higher class licensees may use slow-scan television and facsimile emissions on the Phone bands; radio teletype/digital on the CW bands. All amateur modes and emissions are authorized above 144.1 MHz. In actual practice, the modes/emissions used are somewhat more complicated than shown above due to the existence of various band plans and "gentlemen's agreements" concerning where certain operations should take place.

\*FCC has ruled exclusive allocation for Amateur Radio of 222-225 MHz effective 1/1/90. The 220-222 MHz will be allocated to Land Mobile.

Table. Frequency chart for U.S. radio amateurs (courtesy of the author).

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Once you try an MFJ Speaker Mic you'll never want to be without it. You'll be able to carry your handheld on your belt and never have to remove it to monitor calls or talk.

You'll never have to turn up your audio annoyingly loud to monitor calls because it's handy lapel/pocket clip lets you keep it close to your ear for easy listening.

And you'll never have to clumsily remove your handheld from your belt holder to talk because you can conveniently take the speaker mic in one hand, press the push to talk button and talk. Measure 1 1/4" x 2" x 3"

They come with a lightweight retractable cord that eliminates the dangling cord problem. They feature excellent audio on both transmit and receive. MFJ-284 for Icom or Yaesu; MFJ-286 for Kenwood.

Miniature Speaker Mics, \$24.95 each:

New miniature speaker mics pack all the features of the compact models into a tiny 2" x 1 1/4" x 1/4" package. The lapel pocket clip swivels for even more convenient positioning. Also features transmit LED. Choose from regular or "L" shaped connector. Order MFJ-285 or MFJ-285L for Icom or Yaesu, MFJ-287 or MFJ-287L for Kenwood. MFJ-283 for dual plug Alinco.

## Deluxe 300 W Tuner



MFJ-949D  
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The world's most popular 300 watt PEP tuner. It covers 1.8-30 MHz, gives you a new peak and average reading Cross-Needle SWR/Wattmeter, built-in dummy load, 6 position antenna switch and 4:1 balun -- in a compact 10 x 3 x 7 inch cabinet. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, \$12.95.

## SWR Analyzer

MFJ's innovative new SWR Analyzer gives you a complete picture of your antenna SWR over an entire band -- without a transmitter, SWR meter or any other equipment!

Simply plug your antenna into the coax connector, set your SWR Analyzer to the frequency you want and read your SWR. You can instantly find your antenna's true resonant frequency, something a noise bridge can't do. Covers 1.8-30 MHz (or choose MFJ-208, \$89.95 for 2 Meters). Use 9 V battery or 110 VAC with MFJ-1312, \$12.95.

## VHF SWR/Wattmeter

MFJ-812B  
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Covers 2 Meters and 220 MHz. 30 or 300 Watt scales. Also reads relative field strength 1-170 MHz and SWR above 14 MHz. 4 1/2 x 2 1/4 x 3 in.

## MFJ Multiple DC Outlet

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New MFJ DC Power Outlet saves you space and money. Hook it to your 12 VDC power supply and get 6 DC outlets for connecting your accessories. RF bypassing keeps RF out of power supply from DC line outlet. 13 1/2 x 2 3/4 x 2 1/2 in.

## 12/24 Hour LCD Clocks



\$19.95 MFJ-108B \$9.95 MFJ-107B  
Huge 5/8 inch bold LCD digits let you see the time from anywhere in your shack. Choose from the dual clock that has separate UTC/local time display or the single 24 hour ham clock.

Mounted in a brushed aluminum frame. Easy to set. The world's most popular ham clocks for accurate logs. MFJ-108B 4 1/2 x 1 x 2, MFJ-107B 2 1/4 x 1 x 2 in.

## MFJ Cross-Needle SWR/Wattmeter



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MFJ Cross-Needle SWR/Wattmeter has a new peak reading function! It shows you SWR, forward and reflected power in 2000/500 and 200/50 watt ranges. Covers 1.8-30 MHz.

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## Deluxe Code Practice Oscillator

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MFJ-557 Deluxe Code Practice Oscillator has a Morse key and oscillator unit mounted together on a heavy steel base so it stays put on your table. Portable because it runs on a 9-volt battery (not included) or an AC adapter (\$12.95) that plugs into a jack on the side.

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**upgrade...don't stop now!**  
Continued from page 5

and shorter wavelengths.

But I don't want you to stop here. I WANT YOU TO UPGRADE!

### Here's What You Do

If you are a Novice, your next step is Technician class. This only requires passing Element 3A, and all you need to do is to crack a single theory book. Of the 326 total questions in the Tech examination pool, you will have to

and building your speed up to 5 wpm. Then sit in front of a team of three accredited volunteer examiners, and earn the "plus" rating to your Technician class license. This will open up 10 meters, 15 meters, 40 meters, and 80 meters to you.

If you're already a Technician-Plus, you know the next upgrade—General class. This opens up all worldwide bands for voice and data communications. Earning your General license simply requires increasing your code speed from 5 wpm to 13 wpm, pass-

of 10 will usually get you through the 13 wpm CW requirement.

Make sure all of your written material has been updated through November 1990. If you have older materials, the majority of this information remains unchanged—but why not start out with a fresh book, and know that everything you are studying is right up to date with what will be found on your upcoming exam?

Good news on the Morse code tests! The American Radio Relay League, one of the country's largest volunteer examination groups, now allows their examiners to make up their own code tests with a multiple choice option. Before, you either had to have one minute of perfect copy, or the correct answers to 10 fill-in-the-blank questions.

### Multiple Choice is a Lot Easier!

The W5YI-VEC system allowed their examiners to use multiple choice exams from the beginning. They also allowed their examiners to make up their own tests, and this is why W5YI exams have seemed "easier" than ARRL-type exams.

It's important to choose your VE examination team carefully, and to know what type of test they are going to administer to you. In upcoming issues of *Radio Fun*, we'll give you tips on finding the right test team for your particular style of study.

So welcome aboard the excitement of amateur radio. You are joining half a million other Americans who have studied hard and passed their amateur radio exams. You are also joining many millions of amateur radio operators throughout the world who have studied hard and passed. Be proud of your call letters, but be thinking about your next upgrade, where you might have an opportunity to seek out even shorter call letters that illustrate you have achieved a higher grade license.



Photo C. Another way to study for the no-code license!!

answer 25 on your test. These are in multiple choice format, straight out of the book. You must score at least 75 percent right to pass.

If you have just passed the Technician no-code license test, your next step is to begin listening to the Morse code

ing Element 1B; and studying a single General class theory book containing 286 total questions, 25 of which will be on your multiple choice exam, Element 3B. Seventy-five percent is passing on the written exam. On your code test, seven correct responses out

of 10 will usually get you through the 13 wpm CW requirement.

Each month I'll cover those hidden secrets to successful examination passing, so now is the time to go out and get your new study materials, and to set your goals for the next upgrade just around the corner. Welcome to ham radio, and welcome to your first issue of *Radio Fun*.

NEXT MONTH: All about VE code tests. **RF**

You may contact Gordon West WB6NOA at 2414 College Dr., Costa Mesa CA 92626. FAX (714) 434-0666.

Gordon West WB6NOA is the author of Radio Shack study materials, including books for Novice, Technician, and General, plus code cassettes for Novice 5 wpm and General 13 wpm speed-building. You can hear Gordo regularly on 10 meters, 28.333 MHz, on most weekends in his weekend licensing seminars. With a Novice or Technician-Plus license, you can work him for a WB6NOA classroom QSL card.

License	Elements	Exams
Novice	Element 2 Element 1A	Elementary theory and regulations 5 wpm code test.
Technician	Plus  +Novice Elements	Beginner level theory and Element 3A regulations with VHF/UHF emphasis.
Technician	No-Code Element 2 Element 3A	Elementary and beginner level theory and regulations.
General	Element 3B  Element 1B	General theory and regulations with emphasis on General Class operating privileges and HF operation. 13 wpm code test.
Advanced	Element 4A	Intermediate theory and rules and regulations.
Extra	Element 4B Element 1C	Specialized theory and VEC regulations. 20 wpm code test.

Topics covered consist of: Commission's rules, operating procedures, radio wave propagation, amateur radio practices, electrical principles, circuit components, practical circuits, signals and emissions, and antennas and feed-lines.

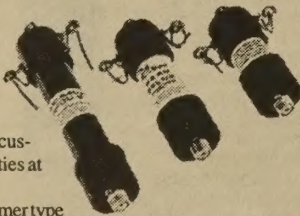
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only a single coaxial cable to the transceiver. Our relays are available in one of two styles Wired or Wireless. The Wireless style uses a separate coupler module installed near the radio. The coupler combines the RF signal and the relay energizing voltage to allow the coaxial cable to carry both signals simultaneously yet independently. The remote relay has a built-in coupler that separates the RF signal from the energizing voltage permitting the relay to transfer its contacts when the energizing voltage is injected into the coupler. This permits existing systems to be expanded with little modification. For more information, call or write for Catalog #IN84.



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# PktGOLD multimode

Advanced Digital Modes -- Software Announcement -- for PK-88, PK-232 tnc - and - MS-DOS computers

## Compare PktGOLD to any other other tnc program. We're waiting...

We are counting on it, on your willingness to research the options. If you do, we think you will want the reliable, user friendly and advanced features available in PktGOLD. We challenge you to compare it to ANY other program, ask users, or better, buy PktGOLD and find out for yourself.

### Look for Host Mode

If you are shopping for a tnc, no doubt you'll be told about all the modes it supports, and an array of great features. What they don't have is powerful user software. Why? Because the tnc ROM code lacks a major and important ingredient: A complete Host Mode. This does not seem like a limitation until you begin talking to PktGOLD users and find out what they can do that you cannot.

### PktGOLD is visibly better

With PktGOLD, you can SEE what is happening. You will KNOW who else is on the air, you will know WHY you are not getting through. Or why other stations are having trouble. You can see what the others cannot see. Have multiple sessions going, it's easy. Transfer a file, cut/paste text, print, execute a DOS command, shell out for a while, edit a message. It's all there.

In AMTOR (a PK-232 mode) you have on the screen information about phasing, idling, sending, receiving. You'll KNOW what is going on at all times. Switching modes on the PK-232 is easy. You can run BAUDOT, ASCII, MORSE, NAVTEX, TDM, SIAM, and the maildrops directly.

### On-line HELP System

Getting started in any new technology involves lots of buzzwords and basic information. Push [F1] and get the information you need. You'll find help on setting up the tnc, wiring and setting audio levels. You'll learn what parameters are used in each mode, and what they do. If you need information on how to operate PktGOLD, just hit the [F1] key for help.

### MultiSession Support

Packet Radio allows many simultaneous "sessions" on the same frequency. PktGOLD doesn't just allow 10 sessions, it supports them, without confusion. People say multiconnects is confusing? With PktGOLD it is simple.

### Conference Mode

Not only can you have multiple sessions, you can have one or more conferences going with stations all discussing something of

mutual interest. For nets, emergencies, or just discussion, conference mode is great, and a snap to setup.

### Network View Screen

Here you are, connected to a Packet BBS asking yourself "What's going on?" or "Is the channel busy?" Now you can be capturing network activity continuously, and display it whenever you wish or on a split screen. Monitoring while connected is helpful, and automatic.

### File Transfers: Binary/Text

Do you have a datafile of the local club members, or a .com or .exe program you want to send (or retrieve)? It's easy with PktGOLD. And you can keep QSOing on the SAME connect while you are transferring a file. It even tells you the effective baud rate, and time left.

### Name and Callsign

How often have you said to yourself "Gee, I remember this call, but forgot the name and QTH?" or worse, you don't even remember the callsign! PktGOLD has a QSL file that allows you to save names and other information. It's there on the screen while you are in QSO. A great help indeed.

### Maildrop Support

Access to the maildrop is easy. It's just another session screen. You can send, read, delete, edit mail, even cut and paste to and from the maildrop.

### Brag Files

Create descriptive files about your station, or anything of interest. You are not limited to just 10 files, with PktGOLD you ask for a list of .BRG files, and they come up, sorted for you, and all you do is move the cursor to the one you want to send, and voila, you send it.

### Cut/Paste

You can retrieve an ARRL bulletin on RTTY (if you have the PK232), then switch to VHF packet, CUT the text to your clipboard, edit it (if you wish), then paste it into a message on your maildrop, or into a local BBS. Cut/Paste can be used to send text to other Packet sessions, or to handle text between modes, or to and from disk or to the printer. A very powerful feature.

### Printer Support

Print from any screen. New text, all text, to a printer or to a print file for later printing. Great for emergency work, or any other event when hard copy is needed.

### Saves QSO text

You can save session text automatically by callsign, and for only certain callsigns, all stations, or none. Your choice. When saved by callsign, it is easy to review ongoing QSOs, just bring up the callsign.txt for the station, and see each qso, the date and time when it started, and ended, and the text.

### NET/ROM Intelligence

On Packet, give PktGOLD a set of nodes separated by the "or bar" (|) and it will do all the sequential connects automatically.

### Quick Connects

Add stations to a list, and you can start packet or AMTOR connects easily.

### More Features

Use only those features you need. The rest are there when you are ready. Like setting monitor modes (43/50) or colors, changing startup options, and more. It's all there.

### What should you do next?

Ask one of our PktGOLD users. They will tell you. Or better, call or write today to order a copy of PktGOLD. Don't miss out.

### To Order PktGOLD

Program & Docs	....	59.95
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Sales Tax	.....	

Total .....

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# 10m Vertical Dipole

*Work DX the easy way.*

by Joseph M. Plesich W8DYF

If you want a simple, easy-to-construct, yet effective 10 meter antenna, this dipole could be just the one for you. The vertical dipole type of antenna is great for local and mobile contacts, and has a low angle of radiation for working DX (long distance) stations. One of its best features is its ability to perform well without a zillion radials (wires or rods extending

dowel into both pieces of the conduit, leaving a gap of about an inch between the two pieces of conduit.

Drill holes through the conduit and fasten the conduit to the dowel with screws. Connect the coax (I used 50 ohm RG-8X) to the conduit. The center conductor goes to one side, and the shield goes to the other side.

I put some COAX-SEAL around

bolts to an 8- to 12-foot long 1 x 3 or 2 x 4. Now it's ready to erect. I just nailed mine to the corner of my garage.

If possible, run the coax away from the antenna at a right angle.

## Performance

After mounting the antenna and running the coax into the shack, I fired up my Yaesu FT-757 and checked

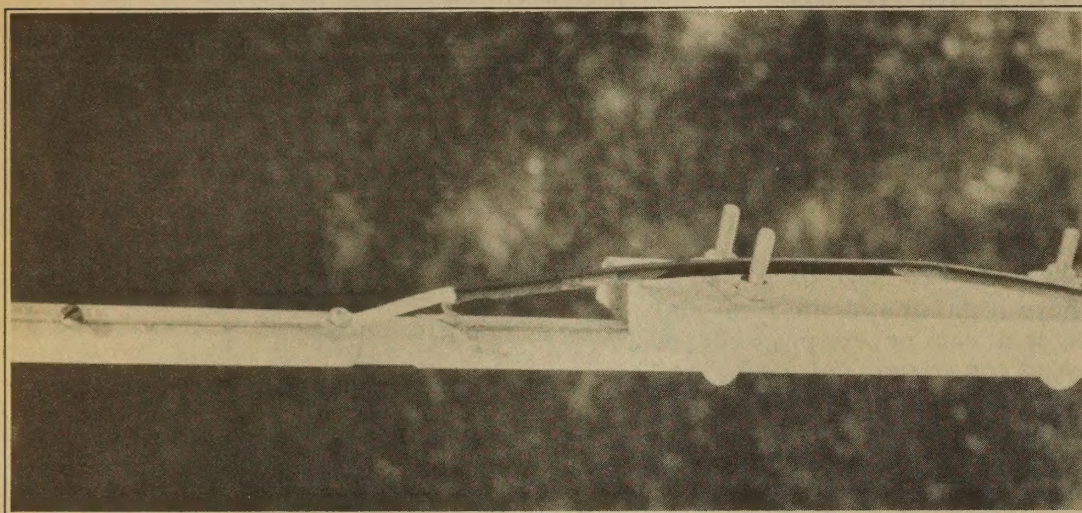


Photo A. There is a 1" gap between the two pieces of conduit. The coax leads are wound around the screws in the conduit. The antenna is fastened to the wood mast with U-bolts.

outward from the bottom of the antenna, for grounding). The cost is less than ten dollars, and you can build it and get it working in an evening.

## Construction

Refer to the drawings and photos. Cut two pieces of 10-foot conduit to 8-foot 2-inch lengths. Insert the 5/8"

the coax to prevent water from getting inside the coax. Then I wrapped the connection with electrical tape. Also, to keep water from getting inside the antenna from above, I put a plastic cap (of the type you can buy for crutches and chairs) on the top and taped it down.

Next, fasten the antenna with U-

bolts to an 8- to 12-foot long 1 x 3 or 2 x 4. Now it's ready to erect. I just nailed mine to the corner of my garage.

Since the SWR was very good, I decided to see what I could work. I built this antenna in July, during the summer doldrums on 10 meters. Nevertheless, during rather poor conditions, my first contact was with an LU in Argentina, and my second contact was with an HK in Columbia. In the next few days, I also had no trouble working stations in the Southwest and on the West Coast.

This may not be the prettiest antenna, but it is cheap, sturdy, easy-to-build, and it works. And it's great fun to work someone across the country or in the next continent with a simple little antenna you have built for just a few bucks. Enjoy!

RF

Joseph M. Plesich W8DYF, 173 Brockton Rd., Steubenville OH 43952.

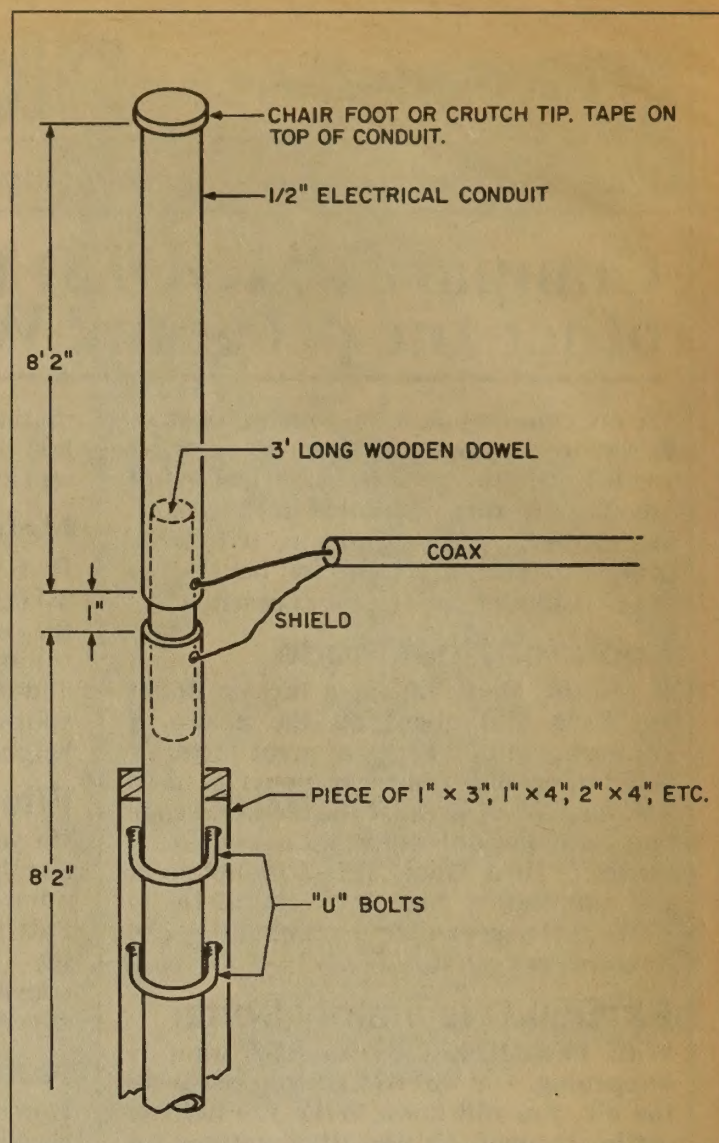


Figure. Construction details of the 10 meter vertical dipole.

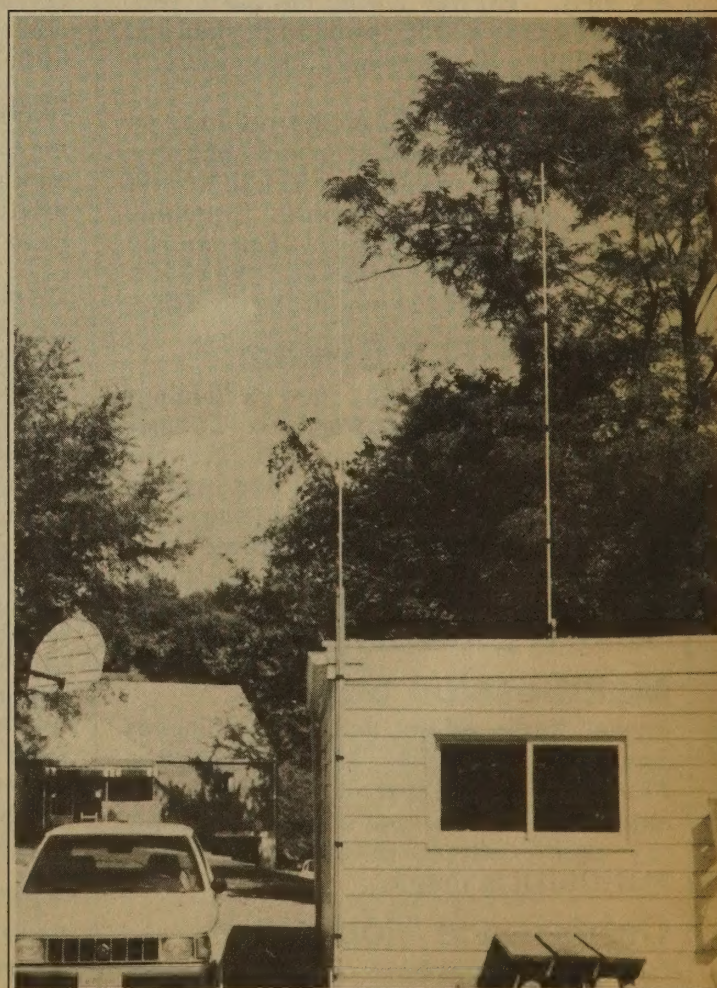
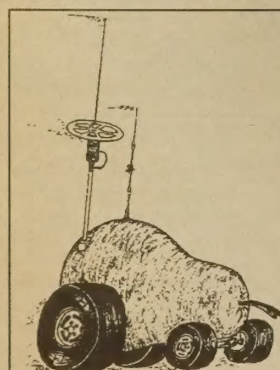


Photo B. The 10 meter vertical dipole, mounted to the corner of my garage. A quarter-wave 20 meter vertical, in the center of the roof, works fine with 6 radials.



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Gold plated center conductor for excellent electrical efficiency!

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446MHz 5/8 Wx3

Gain: 146MHz 5.0dB  
446MHz 7.6dB

Impedance: 50 ohms

VSWR: 1.5:1 or less

Max. Power: 120 watts

Length: 5'

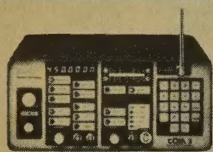
Connector: UHF

## Materials List

- 2 pieces of 10-foot long electrical conduit
- 1 piece of 5/8" wood dowel, 3 feet long
- 2 U-bolts
- 1 plastic chair/crutch tip or cap
- 1 piece of wood for mast, 1 x 3 or 2 x 4, 8 to 12 feet long
- Misc.: tape, Coax-Seal, coax to reach your shack.



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COM-3, the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantastic price—and our new lease program allows you to own a COM-3 for less than \$3.00 a day. Features •Direct entry keyboard with programmable memory •Audio & transmitter frequency counter •LED bar graph frequency/error deviation display •0.1–10,000 µV output levels •High receive sensitivity, less than 5 µV •100 kHz to 999.9995 MHz •Continuous frequency coverage •Transmit protection, up to 100 watts •CTS tone encoder, 1 kHz and external modulation.



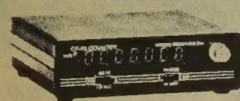
**RSG-10**  
**\$249500**

## SYNTHESIZED SIGNAL GENERATOR

Finally, a low-cost lab quality signal generator—a true alternative to the \$7,000 generators. The RSG-10 is a hard working, but easy to use generator ideal for the lab as well as for production test. Lease it for less than \$3.00 a day. Features •100 kHz to 999 MHz •100 Hz resolution to 500 MHz, 200 Hz above •–130 to +10 dBm output range •0.1 dB output resolution •AM and FM modulation •20 programmable memories •Output selection in volts, dB, dBm with instant conversion between units •RF output reverse power protected •LED display of all parameters—no analog guesswork!

## FREQUENCY COUNTERS

**CT-70 7 DIGIT 525 MHz**



**CT-90 9 DIGIT 600 MHz**



**CT-125 9 DIGIT 1.2 GHz**



Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one-year warranty on parts and labor. We take great pride in being the largest manufacturer of low-cost counters in the entire U.S.A. Compare specifications. Our counters are full-featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry, and durable high quality epoxy glass plated-thru PC board construction. All units are 100% manufactured in the U.S.A. All counters feature 1.0 ppm accuracy.

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Low-pass probe, audio use, LP-1 ..... \$16.95  
Direct probe, general purpose use, DC-1 ..... \$16.95  
Tilt bail, elevates counter for easy viewing, TB-70 ..... \$9.95  
Rechargeable internal battery pack, BP-4 ..... \$9.95  
CT-90 oven timebase, 0.1 ppm accuracy, OV-1 ..... \$9.95

#### ALL COUNTERS ARE FULLY WIRED & TESTED

MODEL	FREQ. RANGE	SENSITIVITY	DIGITS	RESOLUTION	PRICE
CT-50	20 Hz–600 MHz	<25 mV to 500 MHz	8	1 Hz, 10 Hz	\$189.95
CT-70	20 Hz–550 MHz	<50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	\$139.95
CT-90	10 Hz–600 MHz	<10 mV to 150 MHz <150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	\$169.95
CT-125	10 Hz–1.25 GHz	<25mV to 50 MHz <15 mV to 500 MHz <100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	\$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	<25 mV to 50 MHz <10 mV to 1 GHz <50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	\$239.95
PS10B Prescaler	10 MHz–1.5 GHz, divide by 1000	<50 mV	Convert your existing counter to 1.5 GHz		\$89.95



**SPEED RADAR**  
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**complete kit**  
**SG-7**

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. Kit includes delivery. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

### BROADBAND PREAMP

Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 1000 MHz. 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC. PR-2, wired, includes AC adapter ..... \$59.95

### 2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay. PA-1, 40W pwr amp kit ..... \$29.95  
TR-1, RF sensed T-R relay kit ..... \$8.95

### FM WIRELESS MIKE KITS

Pick the unit that's right for you. All units transmit stable signal in 88–108 MHz FM band up to 300' except for hi power FM-4 that goes up to 1/2 mile.  
FM-1, basic unit ..... \$5.95  
FM-2, as above but with added mike preamp ..... \$7.95  
FM-4, long range, high power with very sensitive audio section, picks up voices 10' away ..... \$14.95  
FM-3, complete unit includes case, battery, switch, antenna, and built-in condenser mike. Excellent fidelity, very small, kit ..... \$16.95  
FM-3WT, as above, but fully wired and tested ..... \$19.95  
SMC, miniature sensitive mike cartridge for FM-1, 2, 4 ..... \$2.95

### MICROWAVE INTRUSION ALARM

A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC. Complete kit MD-3 ..... \$16.95

### MUSIC MACHINE

Neat kit that will produce 25 different classical and popular tunes, plus 3 doorbells, shop, or store entrances, car horn, music boxes, etc. Runs on 9V battery or wall transformer. Excellent speaker volume and adjustable tempo and pitch. Add our case set for a handsome finished look. Complete kit, MM-5 ..... \$24.95  
Case + knob set, CMM-5 ..... \$12.95

### PACKET RADIO

Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software. PC board, all necessary parts and full documentation. Complete kit, PC-1 ..... \$49.95

### LO NOISE PREAMPS

Make that receiver come ALIVE! Small size for easy installation with Hi-Q tuned input for peak performance. Excellent gain and noise figure—guaranteed to improve reception! Specify band: 2M—PR-10, 220 MHz—PR-20, 440 MHz—PR-40. Each kit ..... \$17.95

### VOICE ACTIVATED SWITCH

A complete tone decoder on a single PC board. Features: 400–5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts. Complete kit, TD-1 ..... \$5.95

### TELEPHONE TRANSMITTER

Mini-sized with professional performance. Self-powered from phone line, transmits in FM broadcast band up to 1/4 mile. Installs easily anywhere on phone line or inside phone! PB-1 kit ..... \$14.95

### TICKLE STIK

A shocking kit! Blinking LED attracts victims to pick up innocent-looking can you watch the fun! Ideal for office desks, parties, nousey know-it-alls! TS-4 kit ..... \$9.95

### TV TRANSMITTER

Transmit your VCR or TV camera throughout your house. Stable quality signal, tunable Ch 4–6. Accepts standard video and audio inputs. Complete kit, JM-7 ..... \$14.95

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See music come alive! 3 different lights flicker with music. One light each for high, mid-range, and lows. Each individually adjustable and drives up to 300 W. Runs on 110 VAC. ML-1 kit ..... \$8.95

### LIGHT BEAM COMMUNICATORS

Transmits audio over infrared beam up to 30'—use simple lenses to go up to 1/4 mile! Hum free, uses 30 kHz carrier. Great for wireless earphones or undetectable "bug." Transmitter + receiver set, LB56 ..... \$19.95

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### SUPER SLEUTH

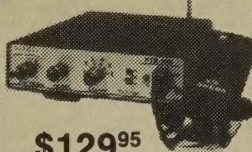
A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output. Runs on 6 to 15 volts, uses 6–45 ohm speaker. BN-9 kit ..... \$5.95

### BROADBAND PREAMP

Very popular sensitive all-purpose preamp. Ideal for scanner, TVs, VHF/UHF rigs, counters. Lo noise, 20 dB gain, 100 kHz–1 GHz, 9V–12 VDC operation. SA-7 kit ..... \$14.95



## FANTASTIC 2M FM TRANSCEIVER SYNTHESIZED—NO CRYSTALS TO BUY!



**\$129<sup>95</sup>**

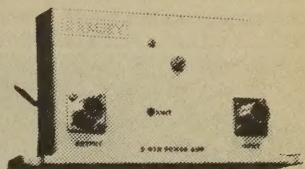
Ramsey breaks the price barrier on 2 meter rigs! Here's the ideal rig for field days, hamfests, vacations, second cars and packet (it even has dedicated packet connections). Six expandable diode-programmed channels, 5W RF output, sensitive dual conversion receiver and EASY assembly. Why pay more for a secondhand old rig when you can make your own for less. Have some fun with your own truly AMERICAN-MADE FM rig! This kit comes complete except for the case, mike and speaker—ICOM or equal speaker-mikes plug right in. Add our own beautiful case set for a professional factory look.

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FTR-146-C aluminum case & knob set ..... \$24.95

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Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz, units. Both have all the features of the high-priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain)  
Fully wired & tested ..... \$79.95  
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Fully wired & tested ..... \$79.95



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(Specify band: QRP-20, 30, 40 or 80)  
Matching case & knob set, CQRP ..... \$12.95

### 20, 30, 40, 80M All Mode RECEIVERS

Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in QST and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.  
Your choice of bands ..... \$27.95  
(Specify band: HR-20, HR-30, HR-40, HR-80)  
Matching case & knob set, CHR ..... \$12.95

### E-Z KEY CMOS KEYS

Send perfect CW within an hour of receiving this kit! Easy-to-build kit has sidetone oscillator, speed control and keys most any transmitter. Runs for months on a 9V battery. 28-page manual gives ideas on making your own key for extra savings. Add our matching case set for complete station look.  
CW-7 kit ..... \$24.95  
Matching case knob set, CCW ..... \$12.95

### ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!  
AA-7 Kit ..... \$24.95  
Matching case & knob set, CAA ..... \$12.95

### SPEECH SCRAMBLER

Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.  
SS-7 kit ..... \$29.95  
Matching case & knob set, CSS ..... \$12.95

### SHORTWAVE RECEIVER



Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4–11 MHz. True superhet has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project provides hours of fun for even the most serious DXer. For the car, consider our shortwave receiver. Two switchable bands (in 3–22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!  
Shortwave receiver kit, SRI ..... \$27.95  
Shortwave converter kit, SCI ..... \$24.95  
Matching case set for SRI, CSR ..... \$12.95  
Matching case set for SCI, CSC ..... \$12.95

### 2, 6, 10 MTR, 220 FM RECEIVERS



Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.  
FM communications receiver kit ..... \$29.95  
Specify band: FR 146 (2m), FR6 (6m), FR10 (10m), FR-220 (220 MHz)  
Matching case & knob set, CFR ..... \$12.95

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### STEREO



Run your own stereo FM station! Transmit a stable signal in the standard FM broadcast band throughout the house, dorm or neighborhood. Connects easily to line outputs on CD player, tape decks, etc. Runs on 9V battery, has internal whip antenna and external antenna jack. Add our case set for a "station" look!  
FM-10 kit ..... \$29.95  
Matching case set, CFM ..... \$12.95

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Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110–136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.  
AR-1 kit ..... \$24.95  
Matching case set, CAR ..... \$12.95

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# Custom-Made Project Boxes

*The easy way to build your own enclosures.*

by David Pelaez AH2AR/8

Looking for some simple ways to construct RF-tight enclosures for electronic projects? The solution may be right around the corner at your local hobby or surplus store. Simple techniques in constructing enclosures and

sided printed circuit (PC) board, have proven to be easy solutions to what may initially appear to be complex problems.

Using these techniques is certainly not an original idea. The first person

two techniques I describe in this article are tried and true, and offer an alternative solution in packaging homebrew electronic circuits. First I'll explain how to design RF-tight compartments, then I'll show you how to use double-

cuits in transmitters and receivers, is sometimes necessary. Many micro-processor-based circuits end up being a source of RF interference if you don't shield them. You can use copper or brass flashing as shielding, cutting it to the right shape and size with a stout pair of sewing scissors or tin snips. Tin snips might be too clumsy for smaller compartments.

To get professional results, draw a box template on some quarter-inch ruled drafting paper. After cutting out the template, lay it on top of the copper or brass flashing. With a pen or small permanent marker, draw the overlay onto the flashing. Now you might want to mark and drill feed-through capacitor holes or shielded line access holes.

Cut out the flashing, using a ruler to ensure an even 90 degree bend on

Photo B. You only need a few tools and supplies.

the four corners of the compartment. Apply rosin core solder in the interior seams to finish the compartment.

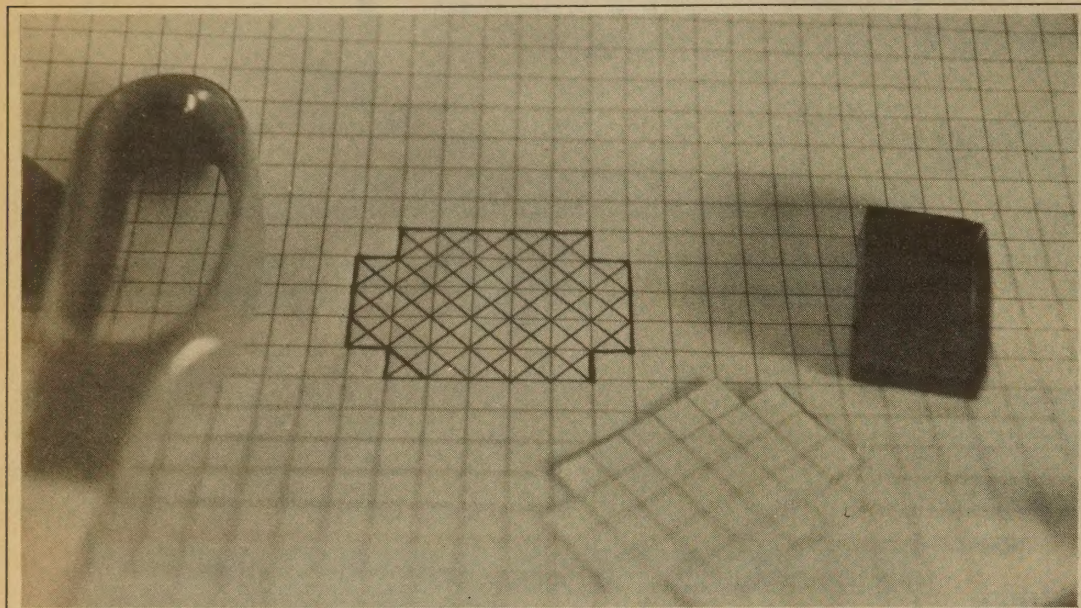


Photo A. The first step in making your own shielding or project box is to make a template. (Photos by the author.)

shielded compartments can help immensely in the quality, performance, and aesthetics of a completed project. Two different kinds of construction techniques, one using copper or brass flashing, and the other using double-

sided PC boards to construct project boxes. to come up with it probably had an overabundance of double-sided PC board. Or maybe it was someone who needed a project box on a Saturday night, and the local Radio Shack wasn't open. Regardless, the

sided PC boards to construct project boxes.

## Flashing as RF-shielding

RF (radio frequency) isolation between stages, and for the tuned cir-

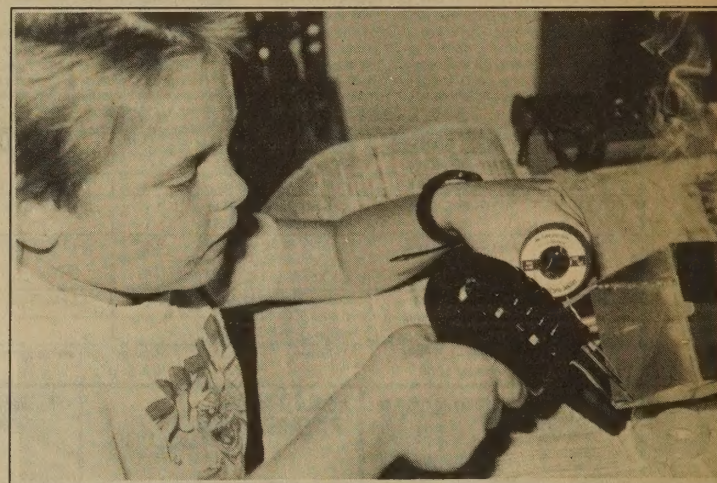


Photo C. Jason N8NDQ mans the soldering gun.

By soldering the access holes, exposed shielded line and feed-through capacitors, and closing the compartment by solder-tacking it on another piece of cut flashing, you have created a near RF-tight enclosure.

## Using PC Boards

This second method creates a larger, more sturdy enclosure that you can use as a chassis or project box. Your box design is only limited by your imagination. I have seen very few people using this creative building technique in home-brew projects, yet the beauty of it is that you're not limiting yourself to what's commercially available.

Also, commercial boxes can cost upwards of \$40 or more, while you can often find PC board material at bargain-basement prices. I've found rather large sheets of the stuff at hamfest fleamarkets for one or two dollars a sheet. A single sheet can produce three or more enclosures, depending on the size of box you need, of course.

Using readily available PC boards and a soldering iron, you don't need sheet metal tools. Also, drilling the mounting holes with a dremel or electric hand drill is a breeze. And the entire surface area, interior and exterior, is a potential grounding point for component/circuit board placement.



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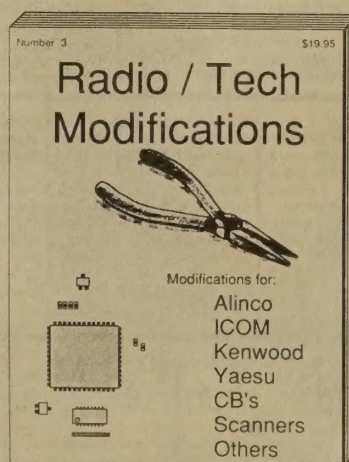
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Lastly, let's not forget the RF shielding potential of a well-soldered copper enclosure.

Properly constructed, PC board enclosures can rival store-bought project boxes in appearance and utility.

### Construction

Not everyone has access to a band saw . . . Yes! PC board can be cut on a band saw if you take the right precautions. You can also use a vise and hacksaw, which is how I do it, though it is a slow and somewhat tedious process. Using some small blocks of wood as vise pads and a metal straight-edge as a guide, a little elbow grease is all you really need to cut the box sides out. Once the sides have been cut out, a light dressing with some wet-or-dry type sandpaper will smooth off the rough edges.

Even in this time of integrated circuits (ICs), CMOS (complementary metal-oxide semi-conductor) devices, and surface mount technology, a large soldering gun can come in handy. In this case, you need one to solder the interior seams of your project box together.

Start by placing one of the boards on a flat surface, and position the second board against a 90 degree step. You can use masking tape to keep the second board in place. Then tack-solder the boards together in two places. Don't solder the two surfaces from end-to-end yet. Place the third side against the 90 degree step and tack-solder this side in two places also. All soldering is done in the interior of the box.

Once you have at least three surfaces tack-soldered together, you can use masking tape to position the rest of the sides. You will find that the box can be gently aligned by a little outward pressure, so it's possible to true up the sides before running an unbroken bead of solder down the interior seams.

To get a good, solid, unbroken bead of solder to bond to the interior adjacent surfaces, a large soldering iron is really indispensable.

Now you've made a project box with one open end.

As noted, holes are easily drilled. To enlarge holes, a conical-shaped chassis reamer from Radio Shack works well. I have also found that the chain files for chain saws are excellent for enlarging and shaping chassis holes in double-sided PC board. Flat files are handy for custom-sizing mounting holes.

Once the sides have been soldered and the holes drilled, you can prep the outside surface by spray-painting an undercoat primer and an additional coat or two of metallic silver or gray spray paint. If you use transfer lettering on the project box, apply several coats of clear enamel spray paint over them to set them permanently and prevent chipping or flaking.

You can make a lid by first cutting PC board to the exact size of the open top, then bordering the piece with a 1/2 inch thick ledge of the same material. This "cap" will fit over the sides of the project box. You can drill four small screw holes through the ledge and the project box. Once you've made these guide holes, you can align and epoxy nuts in the interior of the box over the holes. You can also put rubber feet on the outside of the lid, and

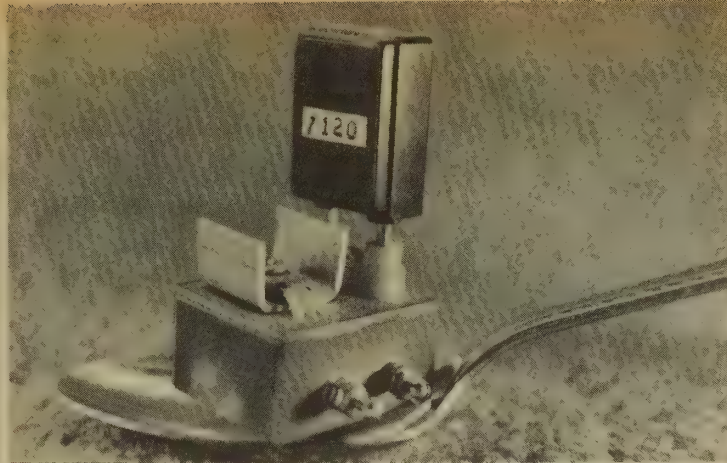
the lid then becomes the base of the project box.

Home-brew enclosures and compartments are easy and practical to make. You can do it with even the most rudimentary tools. Imagine what would have happened if the ancient Egyptians had access to a Weller soldering iron and several hundred thousand cubits of double-sided printed circuit boards?

**RF**

David Pelaez AH2AR/8, 4872 Trailside Ct., Huber Heights, OH 45424.

**Photo D.**  
Just the right size!



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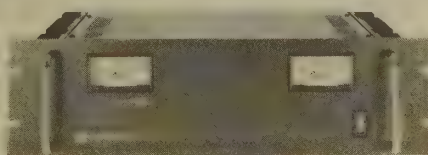


MODEL VS-50M

### SL SERIES

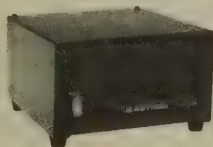


### RS-L SERIES



RM SERIES MODEL RM-35M

### RS-A SERIES



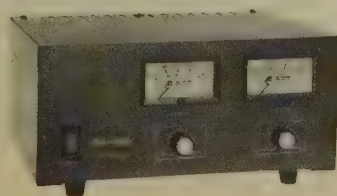
MODEL RS-7A

### RS-M SERIES



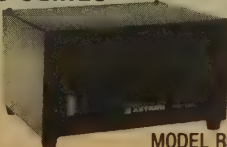
MODEL RS-35M

### VS-M AND VRM-M SERIES



MODEL VS-35M

### RS-S SERIES



MODEL RS-12S

MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
• LOW PROFILE POWER SUPPLY					
SL-11A	• •	7	11	2 3/4 x 7 1/2 x 9 3/4	11
MODEL		Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE					
RS-4L		3	4	3 1/2 x 6 1/8 x 7 1/4	6
RS-5L		4	5	3 1/2 x 6 1/8 x 7 1/4	7
MODEL		Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
• 19" RACK MOUNT POWER SUPPLIES					
RM-12A		9	12	5 1/4 x 19 x 8 1/4	16
RM-35A		25	35	5 1/4 x 19 x 12 1/2	38
RM-50A		37	50	5 1/4 x 19 x 12 1/2	50
RM-60A		50	55	7 x 19 x 12 1/2	60
• Separate Volt and Amp Meters					
RM-12M		9	12	5 1/4 x 19 x 8 1/4	16
RM-35M		25	35	5 1/4 x 19 x 12 1/2	38
RM-50M		37	50	5 1/4 x 19 x 12 1/2	50
RM-60M		50	55	7 x 19 x 12 1/2	60
MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-3A	• •	2.5	3	3 x 4 1/4 x 5 1/4	4
RS-4A	• •	3	4	3 3/4 x 6 1/2 x 9	5
RS-5A	• •	4	5	3 1/2 x 6 1/8 x 7 1/4	7
RS-7A	• •	5	7	3 3/4 x 6 1/2 x 9	9
RS-7B	• •	5	7	4 x 7 1/2 x 10 3/4	10
RS-10A	• •	7.5	10	4 x 7 1/2 x 10 3/4	11
RS-12A	• •	9	12	4 1/2 x 8 x 9	13
RS-12B	• •	9	12	4 x 7 1/2 x 10 3/4	13
RS-20A	• •	16	20	5 x 9 x 10 1/2	18
RS-35A	• •	25	35	5 x 11 x 11	27
RS-50A	• •	37	50	6 x 13 3/4 x 11	46
MODEL		Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter					
RS-12M		9	12	4 1/2 x 8 x 9	13
• Separate volt and Amp meters					
RS-20M		16	20	5 x 9 x 10 1/2	18
RS-35M		25	35	5 x 11 x 11	27
RS-50M		37	50	6 x 13 3/4 x 11	46
MODEL		Continuous Duty (Amps) @13.8VDC @10VDC @5VDC	ICS* (Amps) @13.8V	Size (IN) H x W x D	Shipping Wt. (lbs.)
VS-12M		9 5 2	12	4 1/2 x 8 x 9	13
VS-20M		16 9 4	20	5 x 9 x 10 1/2	20
VS-35M		25 15 7	35	5 x 11 x 11	29
VS-50M		37 22 10	50	6 x 13 3/4 x 11	46
• Variable rack mount power supplies					
VRM-35M		25 15 7	35	5 1/4 x 19 x 12 1/2	38
VRM-50M		37 22 10	50	5 1/4 x 19 x 12 1/2	50
MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-7S	• •	5	7	4 x 7 1/2 x 10 3/4	10
RS-10S	• •	7.5	10	4 x 7 1/2 x 10 3/4	12
RS-12S	• •	9	12	4 1/2 x 8 x 9	13
RS-20S	• •	16	20	5 x 9 x 10 1/2	18
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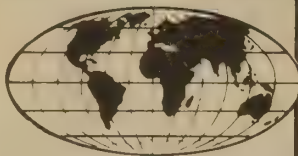


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## what next?

by Carole Perry WB2MGP

### Now That You Have Your License...

The most frequently asked question I've heard in 11 years of teaching amateur radio to youngsters and their parents is, "What do I do next? Now that I have my license, what's the next step?"

Most people work so hard to obtain their FCC amateur radio license that as soon as that first feeling of exhilaration wears off, they discover that they still have many more questions.

Perfectly natural! The first smart move is to report back to the ham or group of hams who helped you get started. If you're lucky enough to have an "Elmer" (an experienced ham to help and encourage you), you can now rely on her or his expertise to guide you through the next steps.

If you somehow managed to obtain your license by studying on your own without the personal contact of another ham, there are several things you can do to help yourself. You can call the American Radio Relay League, telephone number (203) 666-1541, for more information. The ARRL, a national radio organization, can give you a listing of ham radio clubs in your area that are actively involved in testing and recruit-

assorted radio equipment for sale, and to attend forums you're interested in. Most of the popular radio magazines (which you should definitely subscribe to) have listings of hamfests throughout the country. Plan to attend. They can be a lot of fun.

On a grander scale are the national conventions. Many hams plan family vacations around these events. There are so many hams doing so many inno-

like how to equip your first ham station. Should you buy a new rig, a used rig, or build your own? There are people and resource materials to help you decide what is most appropriate for your particular needs, your interests, and your pocketbook. Again, plan to spend time with other hams and do lots of perusing through ham magazines.

Sooner or later, we all come face to



Photo A. I always have a special class session for newly licensed students who need some help.

face with the first QSO (contact). All the hurrying and scurrying has been for this one moment. The oldest living ham among us can probably still recall the nervous excitement we all feel the very first time we're on our own on the radio. "Will I be prepared? What will I talk about? Why should anyone want to chat with me? They'll all know how inexperienced I am. They'll all be waiting for me to make a mistake. I'll be so embarrassed if I get corrected on the air." These are but some of the thoughts and feelings you'll take with you as you swallow hard, take a deep breath, and plunge in.

Rest assured, you're not alone. Amateur radio is a hobby and service made up of some pretty terrific people. Great energies and monies are expended all the time to recruit new people like you. So, welcome aboard! You'll soon be confident and enjoying your-

self like the rest of us. Obtaining your first license is the opening of a whole new world for you. Go out there and get it!

RF

You may write Carole Perry WB2MGP at P.O. Box 131646, Staten Island NY 10313-0006.



Photo B. Many youngsters come back to our classroom so they can get assistance once they have a license.

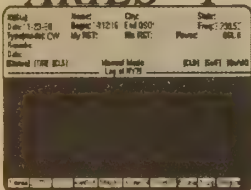
ing. Joining a local club, or even just attending a few meetings, will give you the chance to meet other hams and find out about ham activities that are going on in your area.

Going to local hamfests is a terrific way to meet other hams, too. It's also fun to browse through aisles of

radierie and helpful nature of most hams. It's very important that, as a beginner, you make that all-important contact with an individual or a group who will help steer you into your introduction to on-the-air amateur radio operation.

You'll have many decisions to make,

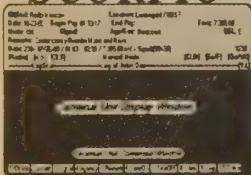
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# An Amateur Packet Radio Overview

## *Simple answers to beginners' questions.*

by Rich Bono NM1D

This article resulted from a non-ham asking some basic questions about amateur packet radio. Several of us thought that this information would be useful to others who are interested in amateur packet operations. Thanks to Tim Dayger for asking the right questions, and to Patty Winter N6BIS for her editing skills. I hope that this will be of help to many of you. You may reproduce and distribute this as long as my credits remain.

### What Is It?

Our potential amateur packet radio operator says: "I've used networks, on-line services, and bulletin board systems (BBS) for years, but I've never really paid much attention to amateur packet radio. I'm starting from scratch, and need to have some idea of where to begin. Just what IS amateur packet radio?"

Amateur packet radio is (yet another) digital transmission method available for use via amateur radio. It provides "error-free" transmission and reception of messages (information/data/etc.) between two stations. This error-free capability is a prime consideration. Error-free in this context does not mean that your typing or spelling mistakes will be fixed, but that all transmitted "data" will be received 100% intact, as sent. In fact, if the data cannot be delivered 100% intact, the transmission will eventually be aborted and the user informed that there is no longer a connection between the two stations.

The "packet" in "packet radio" comes from the method of sending your information over the air. Your data is broken up into packets (or blocks) that are transmitted. Each packet contains the sending and the receiving station call signs, and some optional routing information. A packet can contain from 0 to 256 data (or information) bytes. The users normally do not need to be concerned with this "packetizing" of their messages. Each packet is sent and then acknowledged by the receiver when received. If a packet is not received correctly, then it is automatically retransmitted (up to a maximum number of times). You normally don't have to know about all this to use packet radio because the "packetizing" happens automatically, without any thought or actions required from you.

One of the more popular protocols used for amateur packet radio is known as AX.25. This is based on HDLC (High-level Data Link Controller) technology. There is also a growing TCP/IP user base. If you are not network-oriented, then the details of these protocols are not important to you as an operator of a packet radio station.

Be aware that most packet radio operation at this time is at 1,200 baud. This will seem slow when compared to what is happening on networks, and on telephone BBSs . . . but what is gained is worldwide access, at NO COST. Once you have your equip-

ment, and your license, there are no fees (except for the electricity that your computer and other equipment use). There is a growing number of ama-

teurs who are experimenting with 2,400 and even 9,600 (or higher) baud operation, so it shouldn't be too long before these faster rates become very popular!

### The Equipment, and How To Use IT

"What kind of equipment do I need, and how do I use it with my PC?"

If you own a computer, you already have the most expensive part of an amateur packet radio station. The other piece of equipment that you need is the TNC (terminal node controller). The TNC contains all the software and special hardware that you need. It actually contains the modem (to interface with your radio) and (usually) a microprocessor with the packet software contained in EPROM. You interface your PC (or even a simple dumb ASCII

terminal) with the TNC via your serial port. Use your favorite terminal emulation software on your PC (the same software that you use with your telephone modem will probably work fine). This is just as easy as connecting your computer to a modem. If you don't want to use the serial port of your computer, there are TNCs available that will plug directly into the bus.

If you don't have a computer, then almost any RS-232 ASCII terminal will work with most of today's TNCs.

The most popular packet frequencies in the USA are in the 2 meter band (144-148 MHz). Check out the fol-

Continued on page 14

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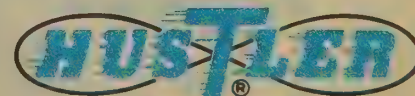
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## packet overview

Continued from page 13

lowing frequencies. (They may be different in your area, so ask a local amateur if you don't hear anything.) Even a typical "police scanner" can be used to listen to these frequencies: 145.01, 145.03, 145.05, 145.07, 145.09 MHz. If these frequencies are busy, many areas also use: 144.91, 144.93, 144.95, 144.97, 144.99 MHz.

Yes, this is with an average FM transceiver set for SIMPLEX operation (transmitting and receiving on the same frequency).

If there are packet radio transmis-

sions you should hear a sound like: BBBBbbbbbrrrrraaaaaappppppp.

"How much technical or hardware proficiency is required to use a packet radio system?"

If you can plug an RS-232 cable into a modem and wire the TNC to your radio, then you have all the ability that you need. I am sure that there are hams in your area who would be glad to help you if you are not comfortable with wiring a microphone connector. Most TNCs connect to the microphone plug of an FM transceiver, normally only needing push-to-talk and transmit audio connections, and a connection to the speaker audio out-

put from the FM receiver. This consists of about five wires, and can usually be done without removing the covers of the radio (these are normally external connections).

Installation is really very simple, and once it is done there is virtually no maintenance. Just plug in your TNC in place of your microphone and external speaker, and you're on the air. To return to voice operation, plug in your microphone. If you like, build a simple switch box to allow easy changing between your TNC and voice operation. I don't recommend it, but some people wire the TNC and microphone in parallel, so that they don't need to

change the plugs or switch anything at all.

## Using Packet

"What's out there for me to access via packet radio, and what potential is there for growth?"

This is the interesting part! I believe that packet radio is still in its infancy. It seems like every day a new application for packet radio is announced. Some are good ideas; others aren't. By the time you read this, a lot of the information presented here will probably be out of date—yes, this technology is progressing!!!

Here is a simple list that barely high-

lights some of the available uses of amateur packet radio.

**E-mail:** At this time we have worldwide e-mail (electronic mail) distribution. I personally have received e-mail from a few continents, and from all over the USA. Of course, this is limited by the amateur radio rules and regulations, so there cannot be any commercial messages.

**Local networks:** Here in New England we have connectivity over most of the region. I can connect to other stations from the following areas consistently: Canada (Montreal), Vermont, New Hampshire, Maine, Connecticut, Massachusetts, Rhode Island and New York. I should note that I am located about 10 miles north of the MA/NH border (in Derry, NH).

Of course, on the HF (high frequency) bands there can be worldwide connectivity, depending on many factors.

**PacketCluster-DX spotting:** This is a specialized system that allows a couple of hundred users to be connected to the same system at one time. It is used by those amateur operators who seek contacts with rare stations throughout the world. When any one user "finds" a rare station on the air, he simply types the information (callsign, frequency and mode) into his terminal, and within a minute or so, all of the other users are informed of the rare station! So-called "DXers" (people who like to hunt these rare stations) LOVE this system. These users can be spread over a wide area. Our local packet cluster system has connectees from Maine to New York.

**DOSGATE:** A system that allows you to execute programs remotely. A DOSGATE system may have many programs for you to use over the air. You don't need to download the programs to use them—you are actually running programs remotely. DOSGATE allows those who don't have a computer to run programs via packet radio.

For example, my DOSGATE system has the following programs available for use by remote packet users.

**AUTOEXAM:** Take sample amateur exams from Novice to Extra. You can use AUTOEXAM as a study guide, or to see if you are ready for a certain license exam.

**SeeSats:** Real-time satellite tracking. Informs you of where the current OSCAR (and other) satellites are located.

**AUTOCALL:** On-line amateur radio USA callsign look-up database.

Simply enter the callsign of any amateur radio operator in the USA and it will print out the name, address, license class and previous callsign (if any).

**GAMES:** Several adventure-style games that can be played on-line.

**Repeater database:** A database of many of the repeaters in the area.

**Gateways:** Even though you may not own any HF or UHF equipment (many packet radio operators only use a simple hand-held VHF transceiver), you can gain access to other bands and operating modes by using a gateway. A gateway allows connectivity between two normally non-connectable communication technologies.

In many areas not only are there major BBSS on the standard 2 meter Technician class frequencies and the 222 MHz Novice class subband, but there are crossband gateways available as well. A Novice on the 222 MHz

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Mid: 1W Low: 0.1W

\* with Optional Battery Pack EBP-18N

Hi: 5W Mid: 1W Low: 0.1W

\* at 9V  
Hi: 2.5W (F1T/S1T) 2W (F4T/S4T)  
Mid: 1W Low: 0.1W

**Weight:**

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with Standard Battery Pack

DJ-S1T/S4T Approx.: 13 oz.:

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band can connect to a station on the 145 MHz band by going through a gateway and thus be able to communicate with many other amateurs.

**Public Service:** Many packet stations are used to help out with sending messages during disasters. Amateur radio operators help out whenever they can, and many hams have their packet stations ready for portable operation to help when needed. There are many training exercises during each year to help practice and test the readiness of the emergency stations.

**OSCAR Satellites:** OSCAR stands for Orbital Satellites Carrying Amateur Radio. We have our OWN satellites in orbit that are dedicated to amateur radio use. There are some satellites that are dedicated to packet radio (sometimes called "PACSATS"). These are for "store-and-forward" operations to help distribute packet traffic around the world.

**Bulletin boards:** These carry postings similar to the stuff on Usenet (or telephone BBSs) and often have archives

of useful files (such as local ham license testing sites). These are usually the same packet nodes that transport e-mail.

**File transfers:** Better at 56K baud (as some hams are doing), but feasible at 1,200 baud. On TCP/IP, you just start it and forget it, so you can do it overnight or at some other time when you don't care whether it takes a while.

**Databases:** In some areas there are HAZMAT (hazardous materials), call-sign, and repeater databases accessible via the network.

**Station-Station:** I almost forgot—many people simply enjoy chatting with their neighbors. This could be with people across the street . . . or in the next state . . . or halfway around the world!

I am sure that I have missed something. You asked about potential. As I mentioned at the beginning, we are just getting started! Many people are just finding out about packet radio. I believe the only limitation is our imagination. We could have a worldwide network (we do currently have a "slow-

speed" worldwide network) in the near future. It just takes a little imagination.

## The Cost

"How much will a packet radio set-up cost me? How COST EFFECTIVE is packet radio?"

If you already own a computer, all you need is a TNC. TNCs can be purchased from about \$120 on up. There are a few for less money, and several that provide for operating on many digital modes in addition to packet radio. For example, the Kantronics KAM will provide for packet (HF:300 baud/VHF:1,200 baud), AMTOR (AMateur Teletype Over Radio - an advanced form of RTTY), RTTY (Radio Teletype), ASCII, NAVTEX, WEFAX (weather FAX), CW (Morse code), etc.

If you already own an amateur FM transceiver (or an HF SSB transceiver), then you have all the equipment needed. If not, a 2 meter FM transceiver can be purchased used from \$100-\$250, new from \$300 on up.

Cost effective . . . Hmmm. Well, first be aware that amateur radio cannot be used for any commercial or business purposes. But where else can one get hours (years) of enjoyment and service out of \$470 (\$350 for a radio and \$120 for a TNC, assuming you already have the computer or terminal)?

Note: This stuff can be contagious . . . be forewarned!!

## Licensing

"What legal issues do I need to consider regarding packet radio? Do I need a license?"

Yes, you need a valid amateur radio license. There is (in the southern New Hampshire area) packet radio activity on the Novice bands. But if you want access to the mainstream of packet radio, you will want at least a Technician amateur radio license. (Although, as mentioned earlier, some areas have an active packet radio network that is accessible with the Novice amateur radio license.)

## Getting More Information

"I've tried reading about amateur

packet radio, but a lot of it is Greek to me. Please suggest some reading material, such as books and magazines, that my campus or local libraries might carry."

There are a few books available on the subject from the ARRL (American Radio Relay League) and Uncle Wayne's BookShelf. One of the best ways is through experimenting with your local packet network or see if you can find a packeteer "Elmer" at your local radio club. An "Elmer" is a friendly, helping amateur radio operator who will take you under his/her wing to help and guide you as much as you need. I hope that you can find someone to help you . . . it takes a special kind of person to be an "Elmer."

Good luck with your packet radio activities. If you find this information helpful, I would be glad to hear from you. How? Simply send me a message via the amateur packet network, NM1D@WB1DSW.NH.USA.NA, from anywhere in the world! **RF**

Rich Bono NM1D, 7 Redfield Cir., Derry NH 03038.

# Proper Terminology

BY ALTON GLAZIER K6ZFV

If you want to become known as an expert in any field, and this is particularly true of ham radio, there is no substitute for knowing and using the proper technical language. Obviously, it's more difficult to impress friends and acquaintances if they have no trouble understanding what you're talking about.

To help you overcome this problem, the following easily understood words and phrases are translated into terms calculated to make you stand out as an authority. Thus,

Don't say:	The proper term is:
It has a handle.	The unit is portable even if it weighs 500 lbs.
The darned thing won't work.	It needs refinement.
I made a lucky guess.	It was a matter of interpolation.
I poured the coal to it.	I worked to maximum operating parameters.
I don't know why the circuit works.	It's a sophisticated circuit.

My gear is the most expensive on the market.

This gear is the ultimate in precision equipment.

I cut and tried until it worked.

The problem was solved by empirical means.

It won't work.

There are technical problems.

The whole damned thing blew up.

This ranges from temporary setback to catastrophic failure.

Lucked out.

Persistent effort resulted in phenomenal success.

Now that you see how the process works, you can easily add many more terms to your vocabulary. A word of warning, though: Be sure you're not talking to someone else almost as smart as you are. You won't know who's doing the snow job—I mean giving the technical explanation.

**RF**

Reprinted from 73, May 1967.

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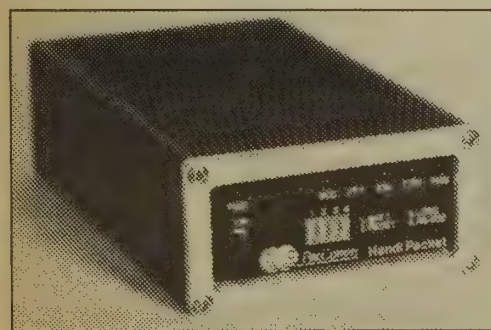
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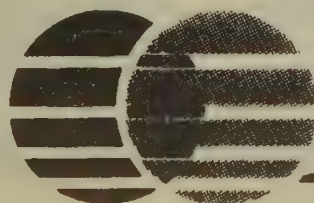


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# Busting a Pile-Up

*Work the rare ones  
with these helpful hints.*

by Michael R. Meltzer K2SDD

You are tuning across the band, and you hear a strong Texas station calling CQ. When he stands by, you and two or three others call him. All stand-by. And then, he comes back to you. Congratulations! You have just taken

part in a pile-up in its simplest form. Does it make you feel good that you beat out the other guys? Of course! There is at least a little competitive spirit hiding in each of us.

What was it that made the Texas

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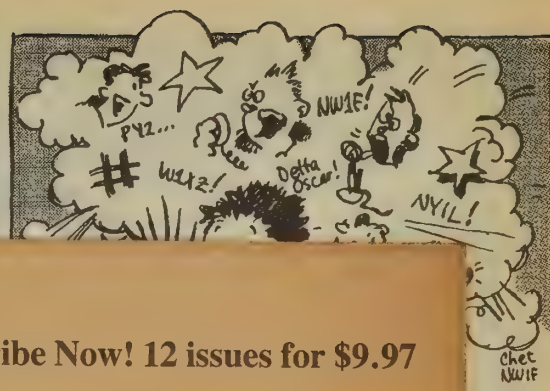
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If he listens over a range of frequencies, see if you can spot who he's working, then plunk yourself down on that frequency and quickly call him the next time he's listening.

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# Busting a Pile-Up

## Work the rare ones with these helpful hints.

by Michael R. Meltzer K2SDD

You are tuning across the band, and you hear a strong Texas station calling CQ. When he stands by, you and two or three others call him. All stand-by. And then, he comes back to you. Congratulations! You have just taken

part in a pile-up in its simplest form. Does it make you feel good that you beat out the other guys? Of course! There is at least a little competitive spirit hiding in each of us.

What was it that made the Texas

station choose you? Was it your superior signal, the proper timing of your call, clean CW tone, or your pleasant voice? All of these and more can make a difference. If you enjoy this kind of thing, it's time for you to start searching for the big stuff. Some pile-ups contain not just three or four callers, but tens or even hundreds. It depends on the rarity and signal strength of the station you're chasing. What can you do to improve your chances of winning that chase?

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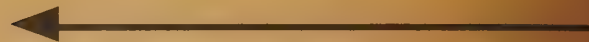
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if you are slightly higher in radio frequency than the pile-up. (For LSB [lower sideband], it's the reverse.) But you cannot just move higher because, to your ears, the station you're trying to work will sound too low in pitch. In a big pile-up, this will make him hard for you to copy. The solution is to set your offset tuning (called RIT on some radios) to minus-point-one kHz (100 Hz low) or even two (200 Hz down). Then, when you tune in the station so that he sounds normal, to him your audio will sound on the high-pitch side.

Find the best RIT setting by getting on-the-air advice from a friend who understands what you are trying to accomplish. Too much offset tuning and you will be unintelligible. This little trick can work wonders, and it doesn't cost a cent.

Now that your rig sounds as good as it can, what's next? Timing. Notice whether the DX station has a predictable pattern. Does he usually come back to someone who begins to call the instant that he stands by? When you finish your call, do you find that he's already halfway through the next QSO? If so, you should try to call more quickly. On the other hand, if the pile-up is so thick with callers that he can't understand anybody, he may wait for things to settle down. It takes nerves of steel, but when he's standing by and everyone else starts shouting, you just wait. Try to time it so that you toss in your call letters at the quiet moment when the early callers stand by. Be courteous, but not meek.

You may have to give your call more than once, but as soon as the DX station responds to someone, stand by and let them go at it. After all, when you finally get through, you don't want your chance ruined by someone who won't stop calling. It's rude for a person to keep calling and make a pest of himself until the DX station answers just to get rid of him. Every hobby has its selfish slobs.

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In a huge DX pile-up, the DX station may work "split." This means that he transmits on one frequency and listens for calls on another. You need two VFOs to participate in split operations.

If he listens over a *range* of frequencies, see if you can spot who he's working, then plunk yourself down on that frequency and quickly call him the next time he's listening.

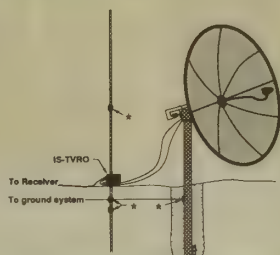
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In the past few months, experimenting on pile-ups with only 5 watts, I was surprised to see how quickly I could work all continents and dozens of different countries. And you can, too. Just remember to have fun. **RF**

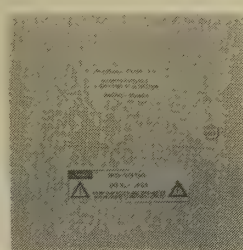
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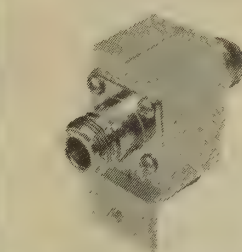
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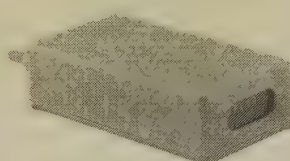
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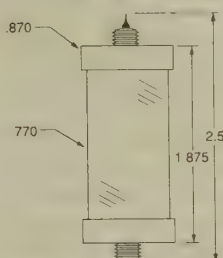
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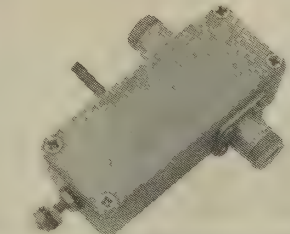
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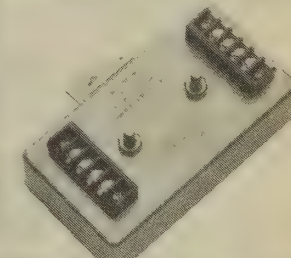
BREAKDOWN TESTERS



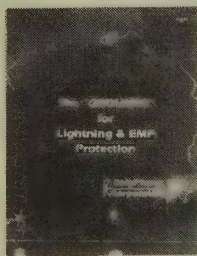
GAS TUBES TO 100 KA



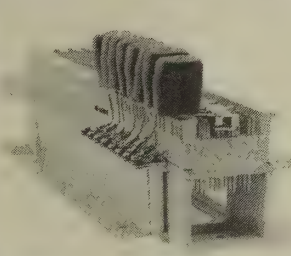
4 TO 23 GHz MICROWAVE DOWNCONVERTERS



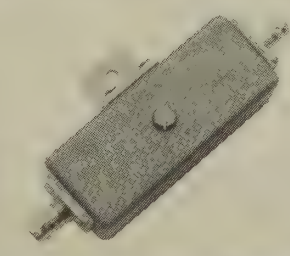
T-1 (TO DS-3 RATES)



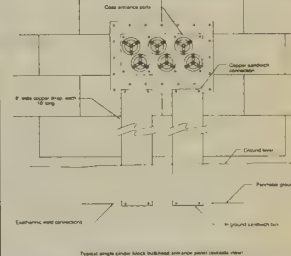
VIDEO & TUTORIAL BOOK



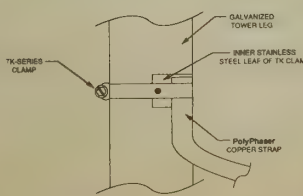
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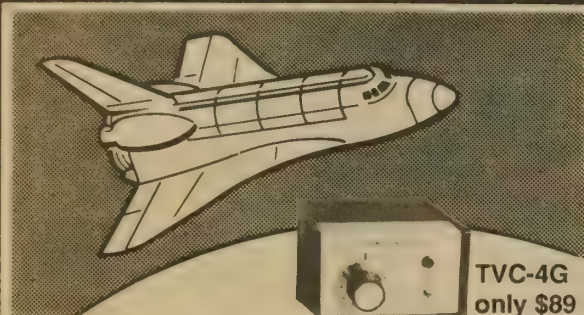
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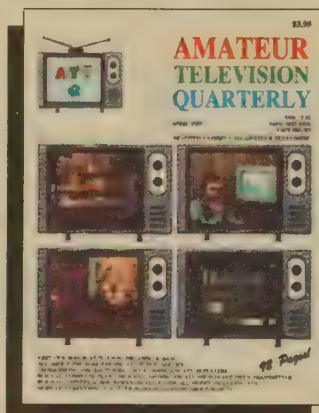
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## try something new

by Bill Brown WB8ELK

If you're something of an explorer, there is more to amateur radio than voice or Morse code contacts. It's a lot of fun talking around the world, or with your friends on the local FM repeater, but there are some unique and different modes that you may want to try.

### Different Modes

In this column I plan to look at some of these different modes (RTTY, Packet, SSTV, and ATV, to name a few) and how you can get involved.

### Amateur Television

One of the modes I find particularly fascinating is amateur television (ATV). This is real-time live-action television, just like your local commercial TV station. Now that you have your amateur radio license, you can actually build up and operate your own two-way TV station. Why wait for the telephone company to come up with the video-phone? It's here now with ATV!

### Where Can You Operate?

Those of you with a Novice class license can operate ATV on the 23 cm band (1270-1295 MHz). Those with a Technician (and Tech Plus) can operate from 70 cm (421.25-439.25 MHz) on up through laser light!

### Be Seen as Well as Heard

Add the dimension of sight to amateur radio communications. Show off your latest computer programs and graphics creations on the air to your friends. Have a problem with your radio or with running a computer program? Put it on TV and have a whole group ready to help you out. Try ATV DXing (the world record is over 1000 miles), or help out with public service or emergency communications. And, of course, you can just sit back and have fun watching your friends hamming it up on TV.

Since ATV equipment is becoming so miniature and portable, you can easily throw your station in your car and set up just about anywhere. A lot of ATVers have fun operating from moun-

tain tops as well as from airplanes. At 5,000 feet, your line-of-sight range is over 100 miles! A number of groups have been taking this a bit further and have been launching their TV transmitters up to 100,000 feet, attached to weather balloons. Anyone within 400 miles can watch the incredible views of the edge of space.

### Tuning in to the Action

You probably have the beginnings of an ATV station if you own a TV set and a camcorder or TV camera. Some of the more recent TV sets or VCRs actually can tune into ATV signals directly. Find out if you have a "cable-ready" switch on your set. If so, hook



Photo A. Jeff KA9TGX working ATV DX from his hamshack in Lafayette, Indiana.

up a good 450 MHz band antenna directly to your VCR or TV and tune in to cable channel 57, 58, 59 or 60 to receive the active UHF ATV frequencies. These correspond to 421.25, 427.25, 433.25 and 439.25 MHz. Channel 58 and 59 are not an exact match to the frequencies used on ATV (426.25 and 434 MHz), but are close enough so that you can tune them in on your set. The most commonly used frequencies for simplex operation are 439.25 and 434 MHz. The other frequencies are generally used for the output of ATV repeaters.

I've found that some TV sets can receive ATV by tuning below UHF channel 14. Two miniature sets that can do this without modification are the Radio Shack Pocketvision models 22, 23 and 24 as well as the SONY Watchman.

### ATV Manufacturers

#### Complete systems:

AEA, P.O. Box 2160, Lynnwood WA 98036. (206) 775-7373.  
PC Electronics, 2522 Paxson Lane, Arcadia CA 91007-8537. (818) 447-4565.  
T.D. Systems, 2420 Superior Dr. "B," Pantego TX 76013. (817) 861-5864.  
Wyman Research, R.R. #1, Box 95, Waldron IN 46182. (317) 525-6452.

#### ATV kits and antennas:

Communications Concepts, Inc., 508 Millstone Dr., Xenia OH 45385. (513) 426-8600.  
Down East Microwave, Bill Olson W1HQT, Box 2310, R.R. #1, Troy ME 04987. (207) 948-3741.  
North Country Radio, P.O. Box 53-A, Wykagyl Station, New Rochelle NY 10804. (914) 235-6611.  
Olde Antenna Lab, 4725 W. Quincy #1014, Denver CO 80236.  
Pauldon Associates, 210 Utica St., Tonawanda NY 14150. (716) 692-5451.  
Rutland Arrays, 1703 Warren St., New Cumberland PA 17070. (717) 774-5298 (7-10 p.m. EST).  
Spectrum International, Inc., P.O. Box 1084, Concord MA 01742. (508) 263-2145.

If your TV doesn't tune low enough, you will need a "downconverter." This takes the UHF ATV frequency and converts it to a channel 3 or 4 output. Just hook up the downconverter between your antenna and the VHF input on your TV or VCR.

### TV Transmitters/Transceivers

You'll need a TV transmitter or transceiver to join the two-way fun. Several companies produce reasonably priced systems. Most of these put out about a watt or so of power. This will net you some local contacts out to 15 miles or so. You really need an amplifier to bring your power up (30 watts or more) to get the most out of

your station. Depending on terrain, you should be able to exchange decent video with stations up to 60 miles away at this power level. Transceivers are available which incorporate the downconverter into a complete package. Antenna switching and all controls are in one box, which makes for a very portable and convenient package.

### Antennas

This is one of the most important "elements" for success. Put your money into your antenna and feedline for best results. An antenna with a gain

of 14 dB or more is a good starting point. Anything less and you'll probably be disappointed. The more popular antennas are the AEA 430-16, the Down East Microwave loop yagis (for 900 MHz and above), the KLM 440-16X, the 48- or 88- element Jaybeam and Rutland Arrays' FO22-ATV.

At UHF frequencies, feedline loss becomes a major factor. RG-8/U coax just doesn't work well here. I recommend a good grade of 9913 type coax or even commercial hardline. Hardline can sometimes be found reasonably at hamfests.

### Where to Find the Action

ATV groups usually use a 2 meter FM calling frequency for establishing contact and discussions of their video. Tune into 144.34 MHz in the Midwest and parts of the East. In parts of Ohio, a secondary frequency of 147.45 MHz is used as well. In Southern California and parts of the West, 146.43 MHz seems to be the most popular. Since other areas may differ, feel free to contact me for ATV information in your local area.

Another good source of information is the weekly HF net on 3.871 MHz from 8 p.m. to 9:30 p.m. every Tuesday night. Net controls are WB9IHS, W9PRD and WB8ELK. Also, a West Coast net is operated by K6DFM and W6YCF on 7.243 MHz every Sunday at 11 a.m. PST.

I hope to SEE you all real soon on ATV.

RF



## NASA Frequencies

Continued from page 1

2.716	Navy Harbor Control-Port Canaveral
2.764	SRB Recovery Channel
3.024	Coast Guard SAR (Primary)
3.187	SRB Recovery Ships Channel
4.376	Primary Recovery Zone SAR
4.510	SRB Recovery Ships Channel
4.856	Cape Radio/Leader
4.992	Cape Radio/Coast Guard Ships
5.180	NASA Tracking Ships
5.187	NASA Tracking Ships
5.190	ETR Primary Night Channel
5.350	Launch Support Aircraft
5.680	Launch Support Ships
5.810	ETR Secondary Night Channel
6.720	SAR Primary Atlantic
6.896	Cape Radio
6.837	Cape Radio
7.412	SAR Communications with Bahamas
7.461	Cape Radio/Launch Support A/C
7.525	NASA Ground Tracking Net
7.676	Launch Support Aircraft
7.765	SRB Recovery Ships
7.919	Data Channel
7.985	Data Channel
9.022	Launch Support Aircraft
9.043	Launch Support Aircraft
9.132	Launch Support Aircraft
10.305	Space Missile Tactical Net
10.310	Malabar-to-Ascension Is-MUX
10.780	ETR Primary Day Channel
11.104	Launch Support Ships
11.252	Launch Support Ships
11.407	SRB Recovery Ships
11.414	Cape Radio
11.548	Cape Radio
11.621	SRB Recovery Ships
13.227	Launch Support Aircraft
13.237	Data Channel
13.495	Data Channel
13.500	Malabar-to-Ascension Is-MUX
13.878	Launch Support Aircraft
14.937	Ascension Is-to-Malabar-MUX
18.009	Launch Support Ships

19.303	Launch Support Ships
19.640	Cape Radio
19.966	Ascension Is-to-Ascension Is-MUX
20.186	Launch Tracking Net
20.192	Malabar-to-Ascension Is-MUX
20.198	OCC Shuttle Mission Audio
20.390	ETR-Secondary Day Channel
22.755	Ascension Is-to-Malabar-MUX
23.413	Cape Radio

TNX Peter Rouse GU1DKD, *Short Wave Magazine*, February 1991, and KD2BD, originator of *Space-news*. **RF**

## Mysterious FCC Activity

Last February, officers of the FCC's Field Operations Bureau (FOB) made a "concerted push" to inspect amateur radio stations throughout the country. An FCC official says about 200 stations were visited. The inspectors asked hams to transmit and cut power 50%, then the inspectors made wattmeter measurements and obtained signal reports. In some newsletters, these inspections were called "power audits."

Why the mysterious power-level checks? Who requested a massive data-gathering effort on amateur power levels? How will this information be used? Amateurs who asked the inspectors these questions characterized the answers as "evasive."

The FOB deals regularly with RFI and TVI complaints from the public. Some amateurs are concerned that the FCC may try to use the data to show that amateur power levels should be reduced, instead of to enforce RFI-immunity standards for consumer products.

The FOB says it performed the tests in conjunction with the Private Radio

Bureau (PRB) and will give the data to the PRB, which regulates the amateur service. "I don't know how they will use the data," an FOB official said.

The PRB says it did not request the inspections and has no plans to use the power level data. Robert McNamara, Chief, PRB Special Services Division, told us, "No, we did not ask for this inspection program. It was one item in a large, thick document that was an agency-wide enforcement plan. The FOB says they will supply us with the data, but we have no plans to do anything with it. There is no plot

Continued on page 30

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## Antenna Products



① **IsoPole™ VHF/UHF Antennas:** three models available — 144 MHz (pictured), 220 MHz and 440 MHz; 3 dBd (maximum gain possible for their respective lengths); zero-degree angle of radiation for maximum range; exceptional decoupling results in simple tuning and significant reduction in TVI potential; broad frequency coverage (see below); typical SWR less than 1.4 to 1 or better across the entire band.

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.....	ISO-220	\$59.95
.....	ISO-440	\$89.95

### IsoPole Specifications:

Model	144	220	440
Freq. Coverage	135-160 MHz	210-230 MHz	415-465 MHz
Impedance	50 ohms	50 ohms	50 ohms
2.1 VSWR bandwidth	10 MHz	15 MHz	22 MHz
	@ 146 MHz	@ 220 MHz	@ 435 MHz
Power Rating	1.0 kW	1.0 kW	1.0 kW
Length	125.5" (3.2m)	79.25" (2m)	46" (1.2m)
Wind Area	< 1 ft <sup>2</sup>	< .75 ft <sup>2</sup>	< .2 ft <sup>2</sup>
Max. Mast OD	1.25" (32mm)	1.25" (32mm)	1.25" (32mm)
Min. Mast Length*	8.0' (2.4m)	5.25' (1.6m)	6" (50mm)
Coax Connector	SO-239	SO-239	Type N

\*Mast not included.

② **Hot Rod™ Telescoping Antennas:** high-performance hand-held antennas; three models available — HR-1 for 144 MHz, HR-2 for 220 MHz and HR-4 for 440 MHz; maximum gain and extended range; higher gain than any 5/8 wave telescoping antenna for handhelds for their respective bands; the Hot Rod is shorter and lighter than a 5/8 wave, placing less stress on the hand-held antenna connector and case; can handle up to 25 watts of power; excellent for portable base or mobile use; when collapsed the Hot Rod performs electrically like helical quarter-wave flexible antenna ("rubber duck") .... **Your Choice \$19.95**



③ **IsoLoop™ Model 10-30 HF Antenna:** compact antenna covering 10-30 MHz continuous (including the new WARC bands); ideal for apartments, condominiums, RVs, portable use; also great for the ham who wants to avoid the hassles of a high-priced high-gain yagi — tower, guy wire, turnbuckles, insulators, concrete, guy stays, rotators, construction permits, etc.; isolated from the feedline to keep stray RF to a minimum; narrow bandwidth reduces TVI potential and attenuates out-of-band signals; handles up to 150 watts; can mount in an attic or on an apartment balcony; weighs only 14 lbs; tuning is accomplished with the small LC-2 remote control box (supplied) which sits in the ham shack (50 ft. motor cable also supplied); omni-directional radiation pattern when mounted in the horizontal plane; vertical mounting provides a null in a desired direction; maximum radiation is always at lower angles than a dipole at the same elevation ..... **\$319.95**

### IsoLoop Specifications:

Nominal Impedance	50 ohms
Power Rating	150 watts
VSWR	Less than 1.5:1 (no nearby obstructions)
Temperature Range	Operating 0 to 150 degrees F Storage -50 to +200 degrees F
Dimensions	43" (109cm) diameter circle
Maximum Mast OD	2" (51mm)
Coax Connector	UHF (SO-239)
Gain over dipole	Depends on elevation
Mast and coaxial cable not included.	

Specifications subject to change without notice or obligation. Prices listed are suggested Amateur Net through participating dealers.

Technical support may be obtained through CompuServe's Hamnet forum. Messages should be addressed to user ID #76702,1013.

## Using an Autopatch

Herald Sawdy NV6E would like to remind new amateurs as well as old-timers about the correct use of autopatch:

- Never, ever use an autopatch to conduct business, order a pizza, or ask your spouse to pick up something at the store. The only exception to this rule is when there is an emergency situation.

- Remember that an autopatch (or any amateur radio communication) cannot be used to circumvent a toll call or the use of a common carrier. Whenever possible, use the telephone.

- Use discretion when you're using an autopatch. Remember that your conversation isn't private.

- Make your autopatch calls as brief as possible. Remember the amateur bands are intended to be used primarily for communications among radio amateurs.

- If you have any doubt about the legality or advisability of using the phone patch to make a call, don't make it. It is much better to spend a quarter on a phone call than lose your license or incur a fine. *TNX Counterpoise*, March '91. Edited for brevity. **RF**

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CONNECTOR: UHF type

■ CA-2 X4J

Mobile Antenna w/Fold-over feature

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POWER: 150 watts FM

LENGTH: 2'4"

CONNECTOR: UHF type

■ CA-2 X4K

Duplexer w/Coax

POWER: 146MHz 800 watts

446MHz 500 watts

CONNECTOR OUTPUT: N-type

146MHz INPUT: UHF

446MHz INPUT: N-type

■ CA-2 X4L

Duplexer w/Coax

POWER: Same as CF-416

CONNECTOR OUTPUT: UHF

146MHz INPUT: UHF

I MODEL 446 INPUT: N-type

K MODEL 446 INPUT: UHF

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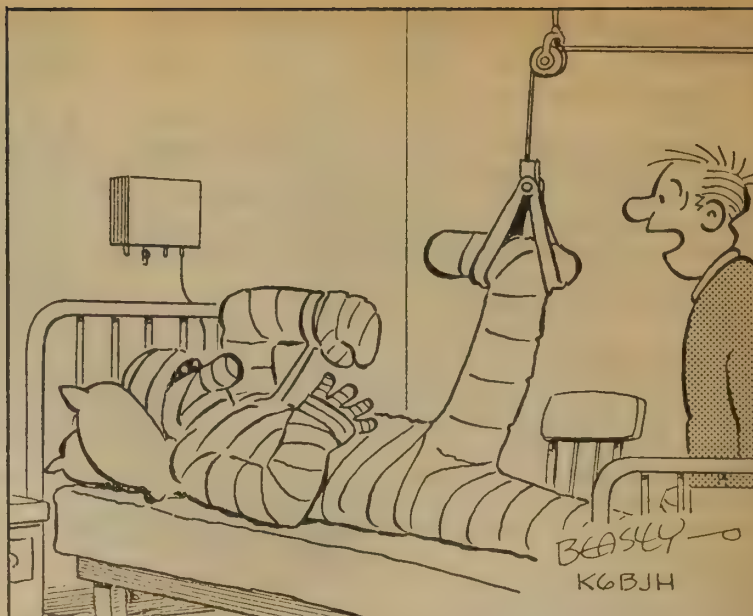
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# RF review

## Ramsey SR-1 Receiver

*Fun listening at affordable prices.*

by Jim Kocsis WA9PYH

Ramsey Electronics offers inexpensive kits ranging from frequency counters to LED blinkers and small receivers. This simple, inexpensive AM-only shortwave receiver is a great starter project for budding hams.

### Assembly

The parts come in a plastic bag with a single-sided phenolic PC board that has a solder mask, but no component markings. The absence of a component layout on the board isn't a problem; the page accompanying the kit shows the location of all the parts. I strongly recommend placing all large components first (transformers, pots [potentiometers], antenna connector, etc.). Next, mount all the resistors and capacitors. Add the transistors, diodes, and ICs last. Don't "jump the gun" like me and forget the jumpers. (I was anxious to see how this little receiver worked.)

This unit is easy to assemble. All but one part fit perfectly; there was not enough room for the large 220  $\mu$ F capacitor at pin 8 of the NE602 IC. I managed to make it fit on top, but you could also mount it beneath the board. The disc capacitors are not all marked as described, but by the process of elimination you can figure out that the 100 pF capacitors are marked 100k, not 101, and the 0.01  $\mu$ F capacitors are marked 0.01, not 103. I would guess that Ramsey switched sources for their parts. This is really a very small point, since overall the assembly was very easy and straightforward.

Two of the transformers need to be modified by breaking out a small internal capacitor. Otherwise, all parts can be used as supplied. There were no extra holes in the board and no extra components. (The appearance of mysterious extra holes or parts can be confusing to the beginner. Ramsey did really well in this area.)

### Tune-up and Operation

I applied power (a 9 volt battery), added a 10-foot piece of wire for an antenna and an earphone, and immediately began tuning in LOTS of shortwave stations. Actual tune-up consists of peaking a single 262 kHz IF transformer and presetting the local oscillator and antenna coils for the desired 2.5 MHz segment of the receiver's 4–10.5 MHz coverage. In a few minutes of listening I heard the BBC, CBC, and Spanish, German, and French stations.

The three controls—RF gain, AF gain, and tune—are potentiometers. Use the RF gain if there's so much signal coming in that the simple AGC circuit can't handle it. The audio output is more than enough for an earphone, but there isn't sufficient audio for even a small speaker.

### Technical Information

This receiver uses the Signetics NE602 for the mixer/local oscillator; a two-transistor IF amplifier with a doubly-tuned transformer comes next. The IF amps are followed by two op amps used as an audio preamp, and an AGC amplifier. A single transistor forms the audio output stage. Current draw at 9 volts is 45 mA, so the battery should provide many hours of listening.

Plusses: The receiver is really hot, mostly due to the NE602. The chip is just coasting in this frequency range—it can actually operate up to 500 MHz RF input with its own local oscillator running at 200 MHz. The assembly, tune-up, and operation are all very straightforward. No special tools or equipment are required.

Minuses: The overriding problem with the receiver is: "What is the frequency?" There is no frequency indication—all tuning is done with a pot-tuned

varicap (voltage variable capacitor) and the oscillator coil. There are also a few heterodynes as the receiver is tuned throughout the selected range. (Heterodynes occur when two frequencies are mixed nonlinearly, producing a sum frequency and a difference frequency.)

This is an indication of inadequate front-end selectivity.

Another problem area involves the RF and oscillator coils. Tuning these coils requires a very small screwdriver-type alignment tool. I've seen these types crack after several adjustments. Adjust them sparingly or consider installing another type of coil.

### An Overall Good Deal

Am I glad I bought this receiver? You bet! I plan on putting it in my car and listening to SW (shortwave) instead of the local AM-FM broadcast "chatter." Ramsey did a fine job on this receiver. The price is reasonable, and all parts are high quality. (Ramsey uses

the same NE602 chip in their 80/40 meter hamband receiver, in a 2 meter receiver and in an aircraft receiver—all reasonably priced.) You can also buy an optional plastic receiver case for \$12.95.

I've been building kits and home-brewing since 1962. I can honestly say that this one was nearly as much fun as the first!

RF

Reprinted from 73 Amateur Radio, August 1989.

Ramsey Electronics, 793 Canning Parkway, Victor NY 14564. (716) 924-4560. Price Class: \$28.

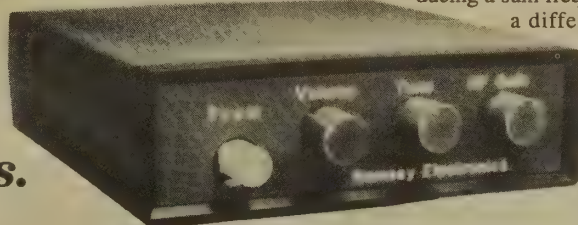
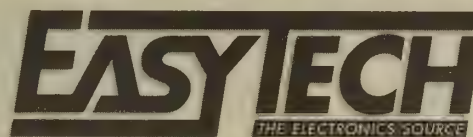


Photo. The Ramsey SR-1 shortwave receiver kit.

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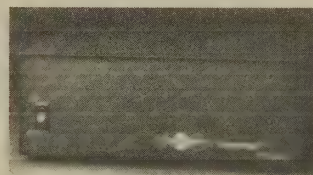
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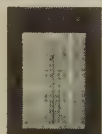
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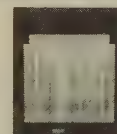
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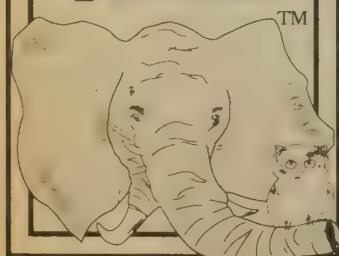
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# RF review

## Ramsey QRP-40 Transmitter

*Quick and easy!*

by Kenny A. Chaffin WBØE

Ramsey Electronics of Victor, New York, provides a painless way to get involved in QRP (low-power) construction and operation. They offer three 1 watt output QRP transmitter kits: for 20, 40, and 80 meters. I first saw these kits advertised in *73 Magazine* and I called to find out more about them.

### Fast Delivery

I ordered the 40 meter version, since that's my favorite QRP band, along with the case kit. When it arrived two days later, I could hardly wait to heat up the old soldering iron. Unfortunately, I had to wait a bit. We have three kids all under three years old, the most recent addition being three weeks old. As you might imagine, this sometimes causes QRM (interference) with my hobbies.

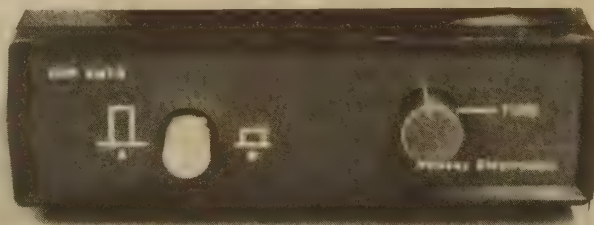
Even so, I didn't waste any time opening up the package and checking it out. The case was machined and marked, and included the front panel knobs, but the connectors and switches were part of the QRP-40 kit. The case kit consists of the plastic case itself, custom front and rear panels, and knobs for the controls which come in the transmitter kit. Having a custom case isn't essential, but it simplifies the project and gives a nice finish. I was pleased with everything I saw.

### Design and Tuning

The QRP-40 arrived in a plastic bag designed to hang on a pegboard display. The bag contained the 4" x 5" (100 x 127 mm) circuit board along with all of the other parts. The first thing I did was pull out the one-page instruction sheet and examine the circuit. It's a four-transistor transmitter design with a VXO arrangement. That

it's a VXO (variable crystal oscillator) circuit wasn't mentioned in the advertisement I saw, but it's explained in the Ramsey catalog.

I was immediately pleased that it allowed for two crystals selectable by



one of the two front panel controls. The other control is a potentiometer for tuning the VXO. The instruction sheet indicated a tuning range of 10 kHz, which was about what could be expected from a VXO circuit on 40 meters.

The crystal frequency of 7150 kHz is on the upper edge of the Novice band. I think it would've been better to have it on the 7110 kHz Novice QRP frequency or the standard 7040 kHz QRP frequency. If you want to operate the recognized QRP frequencies, you have to either order the right crystals or pull

them out of other equipment. The supplied crystal is a standard HC18/U from Jan Crystals, but the instructions say that almost any style will work. (For a free catalog, call or write Jan Crystals, P.O. Box 06017, Ft. Myers FL 33906; (800) 526-9825 or (813) 936-3750.)

### Contents of the Kit

I thought I'd need an antenna switch to connect my vertical antenna to either the QRP-40 or my transceiver, as in the old days when I had a separate transmitter and receiver, but I didn't. The QRP-40 has a built-in diode switching arrangement that provides an antenna output to a receiver! Good job, guys.

Next I checked all the parts against the parts list. Some of the transistors come in a couple of flavors, but the variations are all listed, so it shouldn't cause any confusion. A couple of handwritten additions to the instruction sheet concern the resistor-like inductors that are part of

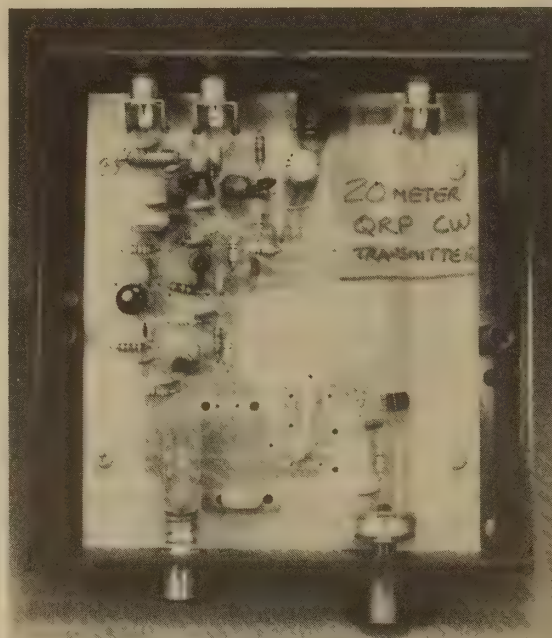


Photo. The Ramsey QRP-20 transmitter kit (similar to the QRP-40).

the kit. If you aren't familiar with this type of inductor, which looks almost like a resistor, it can confuse you. The

most notable difference is that the inductors have silver bands on both ends, and the color code in the middle.

After verifying that nothing was missing, I carefully put all the parts back in the bag and waited for an opportunity to begin.

### Assembly

My chance came the following day. With the kids and wife napping, I sneaked to the basement and heated up the ol' Weller soldering iron. Even though the QRP-40 is a relatively simple circuit with about 50 parts, it doesn't guide you step-by-step (for example, "Insert R31 at position A12."). For this kit, you have to know what resistors and capacitors are, and how to read their values. The entire assembly instructions consist of nine steps:

1. Orient the circuit board.
2. Install jacks and switches.
3. Install capacitors.
4. Connect a 100 ohm resistor to a 220  $\mu$ H inductor, and install as shown on the figure.
5. Install resistors (47k on solder side).
6. Install diodes and transistors.
7. Install inductors.
8. Install crystal.
9. Check all solder connections.

The only difficulty was positioning a couple of the transistors. Q2, in my kit, is almost round. It took me a second to find the flat side. The parts placement drawing was a great help in figuring this out. Q4, on the other hand, is almost square. It does, however, have a couple of missing corners on one side. If you assume this is the rounded side, and the other side flat, you'll have it right.

Unused holes on the circuit board are indicated on the layout drawing, something often overlooked in kits. This makes it easier to check placement.


I completed the entire assembly by the time the kids got up from their naps, in about an hour and a half. This was enough time for me to check and make sure I'd installed and soldered everything properly. Depending on your experience with kit building, allow from one to three hours.

### Apprehension

Power input can range from 12 to 14 volts, so I connected the board to my 2 meter rig's power supply. I

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had to scrounge around a bit to find connectors and adapters to connect the dummy load and antenna. The QRP-40's two antenna connectors and key connector are all phono plugs. Fortunately, from my work with the HW-7 QRP rig and a couple of homebrew preamps, I had phono-to-UHF adapters.

The switch for the crystals is not marked on either the board or the schematic as to which position is for which crystal, but it's relatively easy to figure out. The front panel of the case is marked, but for you who get the kit without the case kit, remember that *out* is position A, and *in* is position B.

I selected position A, the 7150 kHz crystal, and connected the transmitter to my antenna via a wattmeter. I turned the power switch on for about half a second and then quickly backed it off. No smoke. Good. Everything looked fine, so I turned the power back on and pressed the key. Yeah! Power out! The wattmeter showed about 1 watt.

### Adjustment and Tuning

The next step was to check the receiver and verify the frequency. Sure enough, it was at 7145 kHz. Checking the range of the tuning control, which is a 5k pot, gave a range of about 7145 to 7150 kHz. The only internal adjustment is a coil in the oscillator circuit that adjusts the tuning range. Trying various settings and adjustments, I was able to get the lower limit down to about 7140 kHz, but I could never get a range of more than 7 kHz. Close, but not quite the claimed 10 kHz. The tuning range of a VXO is highly dependent

on the type of crystal and other factors, so I don't consider this a significant problem.

Later, I found some old FT-243 style crystals in my junk box and decided to try them just for grins. They seemed to work, though the tone of the output signal was nothing to write home about, and the tuning range was non-existent. It's probably best to avoid older crystals and stick with the newer canned crystals. I tested the transmitter with a wide range of crystals, and the power output remained 1 watt, regardless of frequency.

Installing the board in the case is simple. Ramsey provides rubber feet for the bottom half of the black plastic case. The top and bottom are identical, except that the bottom has two holes for screws to secure the case. The circuit board is a tight fit. Place the front panel on the board and fit these together into the bottom. Four screws hold the board in place. After screwing the board down, you can attach the back panel and top.

I ran into a slight problem with the button for the crystal select switch. It was too loose to fit on the switch shaft, at least in my kit. Folding a strip of paper and inserting it between the shaft and the button snugged up the fit enough.

### On the Air!

Operating on 1 watt with a vertical antenna is a world apart from operating with a kilowatt and a 7-element beam. You have to use a few tricks, like tail-ending, calling a station when he finishes a QSO, or answering a CQ rather than calling CQ.

The first CQ I answered heard me. K5KS in Albuquerque, New Mexico, was my first 1 watt contact. He valiantly gave me a 559, and we chatted for a few minutes while I attempted to contain my enthusiasm. It's quite a feeling to have a QSO going well, and even rag-chewing a little, on 1 watt. Amazing!

The next day I had a contact with Joe N3NJ in Pittsburgh, and with others around the states. I haven't worked any foreign DX with the QRP-40 yet, but others have done it, so it's just a matter of time. I can hardly wait to work New Zealand with 1 watt.

### Conclusion

Ramsey has a limited warranty on its kits, and telephone help if you have problems, but with the simplicity of this particular kit, it should be smooth sailing.

The finished QRP-40 transmitter installed in its case measures about 5" x 5 1/2". It's a nice-looking addition to my station.

Is it worth the money and effort? Absolutely. If you're looking for an easy way to build a QRP rig, this is it. Quick delivery, complete kit with good instructions, and easy operation. And it's always more fun to get on the air using something you built yourself. If you're not into scrounging for parts, this may be the kit for you. **RF**

*Reprinted from 73 Amateur Radio, December 1989.*

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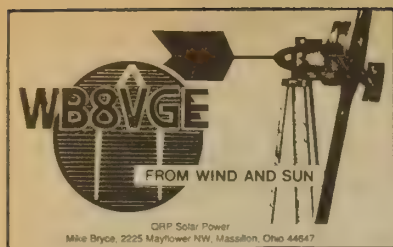
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# radio magic

by Michael Bryce WB8VGE

Radio has always been a mystery to me. My first radio was a crystal set my dad bought for me one Christmas. It was a kit. The radio was called the Remco Super Crystal Diode Receiver. Oh my, it was a fancy one, with a slider tuning, fancy blue cabinet, and real honest-to-goodness headphones. (I would later find out that these were called "cans" by the ham radio operators.) Best of all, the radio required no batteries. This was truly a super radio!

My dad, bless him, was never one for electricity, let alone radio. In fact, to this very day he needs instructions to change a light bulb. But the good sport that he is, he jumped in with both feet, with me right by his side watching his every move.

Since the crystal set was in kit form, we had to wire in the different parts according to the drawing. There was nothing of any great mystery here, I thought, just a lot of wires. Then, from a yellow envelope, it came: a germanium diode! "This," I shouted, "must be what makes the radio work!"

As it turned out, we spent most of the day trying to figure out the drawings. Then we spent the rest of the day

running an outside antenna to a nearby tree and trying to come up with a suitable ground. Then the moment of truth was at hand. I turned the set on, and it worked! Instantly, I heard the local broadcast station. That's all it took, and I've been hooked on radio ever since.

## Types of Diodes

Looking back at my first radio, the magic that made it all possible was, and still is, the diode. A simple component made of silicon or germanium. There are, of course, other materials that are used to make diodes, such as selenium, which is still found today in battery chargers. But silicon or germanium are the most common diode materials.

Diodes made from silicon or germanium are usually classified as PN junction diodes or point-contact diodes. Junction diodes are used from DC to the microwave region of the frequency spectrum. Point-contact diodes are generally used in RF applications. The difference between the two lies in how they're constructed internally. The diode used in my crystal set was a 1N34A germanium diode. This diode is a point-contact diode.

## Properties of the Diode

By attaching a piece of P-material to a piece of N-type material, we end up with the PN junction. If we connect the positive side of a battery to the P-junction, and the negative side to the N-junction, current will flow through the circuit. Electrons will flow across the boundary of the two types of materials. This boundary is known as the junction barrier; a drop in voltage is associated with it. Most silicon diodes have about a 0.7 volt drop across the junction. Germanium diodes, on the other hand, have about a 0.3 volt drop. This voltage

drop can be most useful in specific designs for radio equipment.

In the above example, if we connect the battery up backwards, no current will flow. This is a second important feature of the diode: A diode will only pass current in one direction! It's a kind of one-way valve for electrons. Because diodes will pass current in one direction and one direction only, they are polarity-sensitive.

One end of the diode is called the anode, and the other end, the cathode. With glass diodes, the cathode end of the diode is marked with a strip or band. Larger diodes may even have the symbol stamped on their case. For

proper location as need be. Diodes can also protect our equipment from being connected up backwards to the power supply or battery.

There are two different ways to protect our gear from reverse polarity. Both versions require one silicon diode, nothing more. The first method is to install a diode in series in the positive lead of the radio. Because the diode will only conduct when the anode of the diode is connected to the plus voltage, we have established our one-way valve in the supply line. Connecting the radio's power leads backwards will cause no damage to the radio. In fact, nothing will happen. No current will flow and the radio will be protected.

## Polarity Protection

But there is one drawback to this solution. The junction of the diode will drop 0.7 volts from our power supply.

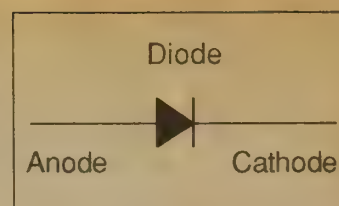


Figure 1. Schematic symbol for a diode.

the positive lead and the anode is connected to ground. To make this work, a fuse MUST be installed in the positive lead of our radio. The fuse must have a current rating of less than peak current of the diode used. Here's how it works.

When the power leads are attached correctly to the supply, nothing happens. If by mistake the leads are reversed, the diode conducts, causing a short circuit. This blows the fuse and protects the equipment. This method is by far the most popular reverse polarity protection scheme around for high current applications. A simple diode can save you hundreds of dollars on repairs.

## Diode Duties

In addition to serving as a switch, diodes can do many more important duties inside our radios. Diodes are used for gates, frequency multipliers, capacitors, clamps, detectors, and voltage references. Diodes can also be made to generate light when current is passed through them (the LED, or Light Emitting Diode), and some diodes generate current when light strikes the PN junction (the silicon solar cell).

What made my crystal radio work without batteries? The 1N34A diode! Diodes do something else for us: They rectify (change) an AC voltage to a DC voltage. My little crystal radio picked up the signal from the local broadcast station via the antenna. The diode changed the RF (which is really high frequency AC) into a DC voltage. The headphones were then able to change the faint DC voltage to audio for me to hear.

As we learned earlier, diodes conduct or turn on when the current is flowing in one direction, and one direction only. The common juice you get from the wall socket is AC at 60 Hz. The voltage swings back and forth 60 times per second. If we were to use a transformer to reduce the 110 volts from the wall down to something we could use, say 12 volts AC, a diode connected in series would turn on and

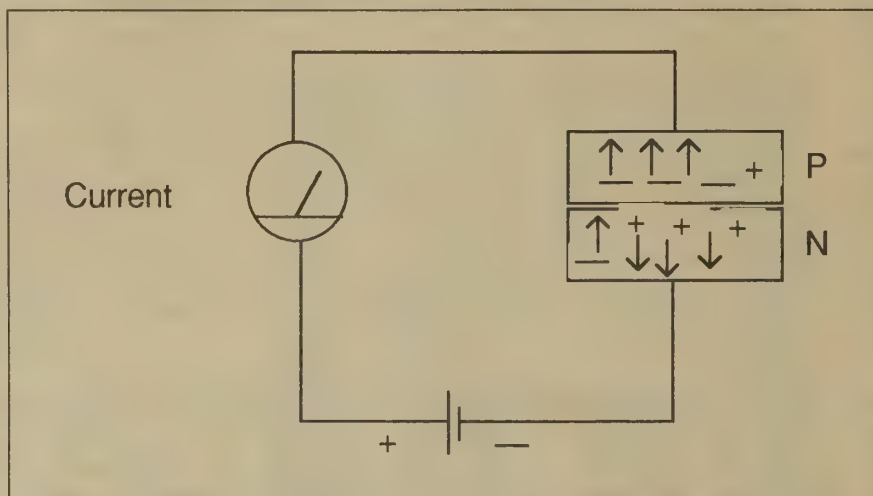


Figure 2. The current flowing in a diode. Reverse the battery, and no current will flow.

a diode to work properly in a radio circuit, it must be installed correctly with respect to the anode and cathode. If a diode is installed backwards, the circuit will fail to operate normally.

## Uses of the Diode

Because of the diode's one-way flow, diodes make excellent switches. By applying a voltage to the diode, we can turn the diode on and off. This is also known as having the diode conduct. Diodes can steer a voltage to the

If the radio draws a small amount of current, the voltage drop won't cause us much concern. However, if the radio draws lots of current, the diode must be quite large to handle the current. The voltage drop across the junction barrier will then be converted into heat, and the diode must get rid of this excess heat or be destroyed.

A second and perhaps more dramatic solution is to connect the diode from the positive lead to ground. The cathode of the diode is connected to

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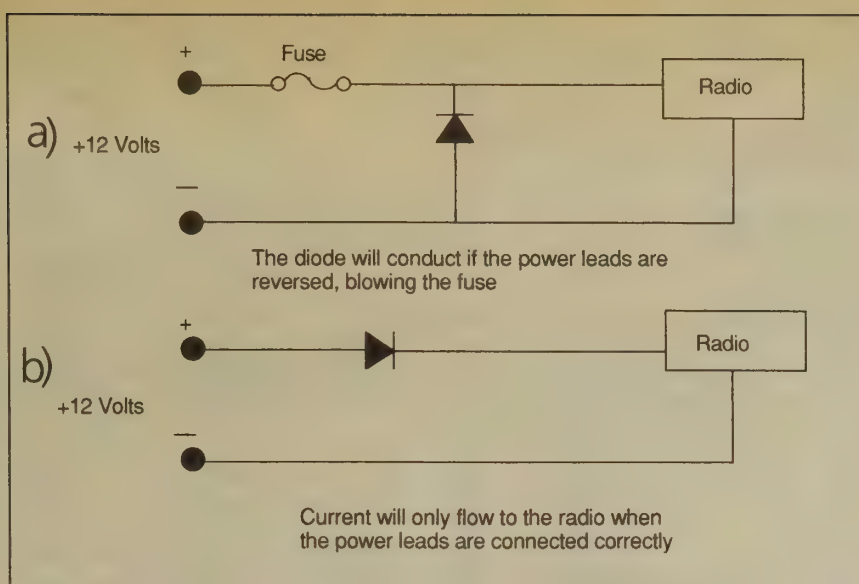


off as the AC swings back and forth. The diode would change or rectify the AC to DC. Using only one diode leaves us with only half of the AC rectified; the other half did not turn on the diode. The solution is to use two or more diodes to conduct on all the swings of the AC voltage. Add some filter capacitors and a regulator, and you'll end up with a DC power supply to operate your newest radio with. Diodes still remain a large part of radio!

Well, that's about all the space this time. I'm glad to be part of *Radio Fun*. As my old English teacher said, "Anyone have any quotes, comments, or questions?" If so, I have a big mail box and a friendly mailperson. **RF**

Write Michael Bryce WB8VGE at 2225 Mayflower NW, Massillon OH 44646.

**Figure 3.**  
**Two methods of reverse voltage protection. Remember to use a fuse with a current rating less than that of the diode when using method (a).**



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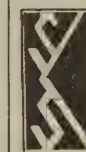
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# the tech side

by Michael Jay Geier KB1UM

## Not Cheap, But Worth It

Welcome to the wonderful world of amateur radio! Most likely, you've just gotten your "ticket" and can't wait to get on the air. Just as likely, you're bewildered by the tremendous variety of equipment you can buy to operate on the various bands and modes. You may also be bewildered by some of the prices!

Yes, new ham radio gear is not cheap. Generally, though, it represents good value. How can those both be true? Well, you spend a lot of money, but you also get a lot of radio. Today's rigs have so many "convenience" features that you may be inconvenienced by having to read and remember a big operating manual! But it's worth it. Those features really enhance your operating pleasure. And operating is what ham radio is all about, right? Well, maybe . . .

## Like a Diamond

Like other gems, ham radio has many facets. If, like many of us, you started out in radio by operating CB, you know that it's fun to talk to people through the air. Unlike CB, though, ham radio gives you much, much more than mere talking across town, or the occasional interference-plagued "skip" contact. There's television (ATV), radioteletype (RTTY), packet (computer communications), worldwide narrowband still-picture TV (SSTV), and perhaps even good ol' Morse code

(CW). There's also satellite (yes, you really can talk through a satellite!), fox hunting (finding hidden transmitters), and the challenge of low-power (QRP) operation. But even with all this territory to explore, operating can get a little boring after awhile. Let's face it, how much would you have to say to a stranger on the street? Why should it be different over the air?

There's another side to amateur radio, and I urge you to check it out. I'm talking about the technical side of the hobby. Yup, building and fixing your own radio gear. I know, you're thinking that you don't know enough, that you could never learn to do that, that it's only for eggheads and engineers. Well, it just ain't so. Heck, I have a degree in music, not engineering. And I build and fix stuff all the time. Why? Because it's fun, that's why!

I won't kid you—this stuff can get as complicated as you want it to, just like any other skill. But just because you're not Eddie Van Halen doesn't mean you can't learn to play the guitar. And you don't have to have an engineering degree, or even great math skills, to get involved with the technological side of the hobby.

Really, you couldn't completely avoid it, even if you wanted to. You had to learn Ohm's law and a little about antennas and frequencies and such to get your license, right? And you will need to know how to hook your new radio up and get it going, too. So, some basic understanding

of electronics is really necessary. Why would you want to know more?

## BIFTY

"Because It's Fun, That's Y." BIFTY—the prime reason you got a license, and the motivation that will keep amateur radio fresh and interesting your entire life. And I don't think any achievement, from DXCC (an award you can get for talking with hams in 100 countries) to working (talking with) the space shuttle, can feel quite as good as making a contact, any contact, on a radio you built yourself. Well, maybe helping someone via public service or disaster communications would feel even better. But you can start building something tonight.

There's a practical side, too. If you think buying the gear is expensive, wait'll you send it in for repair. Not only does it cost a lot, it can also take a while. You may sit, frustrated, without your rig for weeks or even months. If you fix it yourself, you might have it back on the air the same day.

## That Used Feeling

If you can't afford that gleaming new equipment, a great way to start out is with used gear. Both radio stores and private individuals sell pre-owned rigs, and they can be great. In fact, we have "hamfests," which are basically electronics flea markets, for that very purpose. And they are a blast! Imagine hundreds or even thousands of hams, walkie-talkies (we call them HTs-

"hand-held transceivers") attached to every one of them, strolling past table after table of items for sale. Some of the stuff is junk, of course, but mixed in may be some great gear at bargain prices.

Unfortunately, buying used gear at hamfests is risky if you don't know very much about what you're buying, and sometimes even if you do. Just because the seller says the thing works doesn't mean it actually does. Or, it may work but not too well. When you're just starting out, a far better approach is to buy a used radio from a reputable radio store or a trusted friend. You might pay a bit more, but that way you can be assured that the rig works, and with a store-bought rig, you'll also receive a warranty of some sort in case your treasure dies right after you get it.

## Something to Build On

Building your own gear does not have to mean trying to whip up an HT from scratch. Truthfully, you will probably never build any radio as sophisticated as one you can buy. So why do it? Well, BIFTY, of course. Also, you can build things you just can't buy, like a pocket-sized low-power radio that can be heard around the world. Or a fold-up portable antenna. Or a switchbox that lets you use one radio for more than one purpose. And so on.

Actually, you don't have to build anything from scratch if you don't want to. In fact, you're better off getting your feet wet by building a kit. In the "good old days," the Heathkit company made all kinds of terrific, low-priced kits, from transceivers to wattmeters and other accessories. They're still around but, alas, their ham radio department is in decline, offering only a few kits. But other companies are taking up the slack. Ramsey Electronics makes some dandy little kits, including receivers, transmitters and other devices. They're very reasonably priced, too. And Radiokit also has some neat stuff. Once you

build one of these things, you'll be hooked.

## Getting Started

If you don't already have any tools, you are going to have to get a few. A small soldering iron is a must. Don't get one of those 100-watt guns; they're too big and too hot. Get a small iron in the 25-watt range. Get a stand and a cleaning sponge. And, of course, some electronics-grade solder. Radio Shack has all this stuff at decent prices. While you're there, get some diagonal cutters, needle-nose pliers, and small screwdrivers. Pick up a roll of stranded hookup wire. Finally, get a meter, either an analog VOM (volt-ohm-milliammeter) or DMM (digital multimeter). With these basic tools, you're all set to build a small kit or start learning to troubleshoot.

Get an experienced friend to show you how to solder. It's very easy, but you can do it wrong and cause problems if you don't know the correct procedure. Read the instruction manual that came with your meter and try testing a few batteries to get the hang of using it. Practice using the diagonal cutters to strip the insulation off the end of the hookup wire.

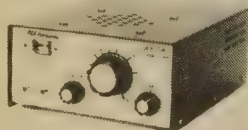
Set aside some work space near your radio setup (your "ham shack"). Good lighting is essential, so don't try to work in a corner of a room lit only by a 40-watt bulb. A high-intensity desk lamp is very useful. If you smoke (you don't, do you?), don't even think about doing it while building or fixing electronic gear. Nothing gums the inside of a radio up worse than tobacco residue (kinda like what it does to your lungs).

Above all, *be careful*. No hobby is worth your life, so respect the serious energy you're playing with. If you don't know the basics of electrical safety, get an experienced friend to show you the ropes. Also, there are various books available. I urge you to take the subject seriously. Just recently, a well-known ham was electrocuted while attempting to fix his transmitting ampli-

Continued on page 28

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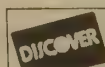


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## advertiser index

Advertiser	Page	Advertiser	Page	Advertiser	Page	Advertiser	Page	Advertiser	Page
A & A Engineering.....	26	Bilal Company.....	20	ICOM America.....	CV2	NCG.....	20	Software Systems.....	20, 28
Ace Systems.....	20	Broadcast Technical		Interflex Systems.....	7	New Dimension QSL's.....	26	Sound Communications.....	23
Advanced Electronic		Service.....	28	Jan Crystals.....	12	North Olmsted		TCE Labs.....	26
Applications.....	19	Buckmaster		Jo Gunn Enterprises.....	26	Amateur Radio.....	28	Texas Bug Catcher Antenna.....	8
Alinco Electronics.....	14	Publishing.....	20, 28, 30	KDC Sound.....	28	P.C. Electronics.....	18, 29	Unadilla Antenna Manufacturing	
All Band Radio.....	28	Cellular Security Group.....	20	Kenwood USA		Pac-Comm.....	15	Company.....	6
Amateur Radio School.....	23	Coaxial Dynamics.....	27	Corporation.....	CV4	Personal Database.....	22	Universal Radio.....	27
Amateur TV Quarterly.....	18	Dandys.....	24	Lentini Communications.....	20	Polyphaser.....	17	Van Iderstine & Sons, Inc.....	28
Antennas West.....	12, 18, 24, 25	EasyTech.....	21	M. Bohnoff.....	28	QSO Software.....	23	Vanguard Labs.....	28
Artsci.....	10	Gap Antenna Products.....	15	Maxcom, Inc.....	27	Quement Electronics.....	29	VHF Communications.....	30
Ashton ITC.....	12	GGTE.....	26	MFJ Enterprises.....	5	Radio Amateur Satellite.....	10	Visual Concepts.....	28
Astron Corporation.....	11	H & M Jewelry.....	28	Michigan Radio.....	25	Ramsey Electronics.....	9	Yaesu Electronics	
AXM, Inc.....	28, 30	Heil Sound.....	20	Mirage/KLM.....	16	Satellite City.....	22	Corporation.....	CV3
Barry Electronics Corporation.....	3	Hustler, Inc.....	13	N4EDQ.....	20	Sensible Solutions.....	27		



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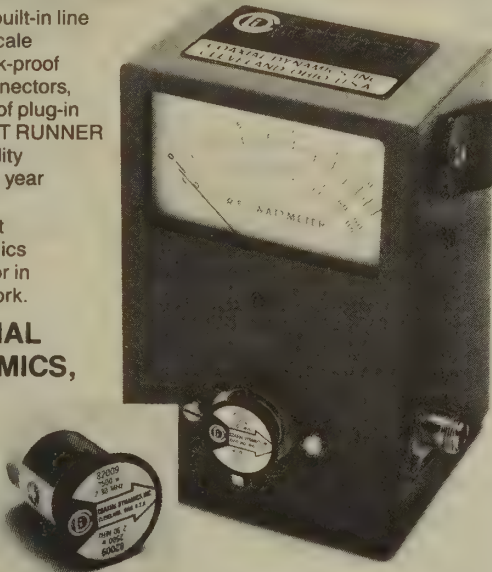


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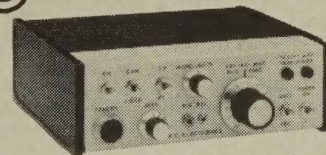
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## mysterious

### FCC activity

Continued from page 19

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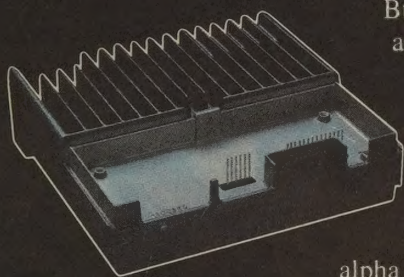


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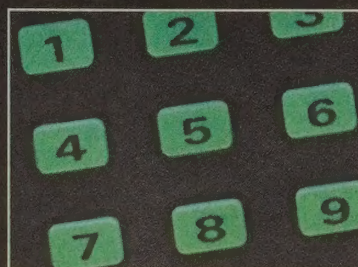
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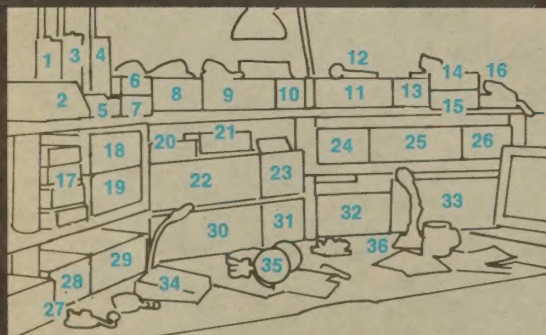
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